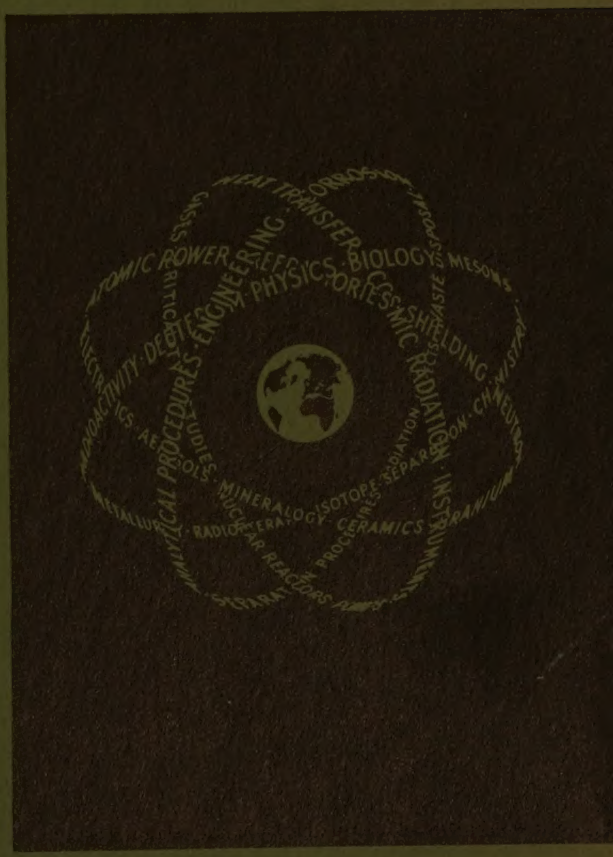
NUCLEAR SCIENCE ABSTRACTS



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A Semimonthly Publication of the United States Atomic Energy Commission Office of Technical Information

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Use of funds for printing this publication has been approved by the Bureau of the Budget, July 29, 1960.

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Volume 14, Number 21, November 15, 1960

Legal Notice

CORRECTIONS

NSA Vol. 14, No. 10, p. 1175. In abstract 9254, Air Univ. Quart. Rev. II should be Air Univ. Quart. Rev XI.

NSA Vol. 14, No. 13, p. 1607. In abstract 12713 Anal. Chem. 32: 63R-7R(1960) April should be May.

NUCLEAR SCIENCE ABSTRACTS

Volume 14 Number 21 November 15, 1960

GENERAL AND MISCELLANEOUS

21182 AECL-1000
Atomic Energy of Canada Ltd., Chalk River, Ont.
PRESENTATION TO THE HOUSE OF COMMONS SPECIAL COMMITTEE ON RESEARCH. J. L. Gray. 1960. 134p. AECL.

A broad statement is presented on the history, organization, responsibilities, objectives, facilities, and general activities of Atomic Energy of Canada Limited. The Canadian atomic power program and co-operation with other countries are discussed. Radiation safety, reactor safety, and waste management are considered. A general discussion is presented on each of the divisions at Chalk River. (W.D.M.)

21183 AECU-4642
Columbia Univ., New York.
ELECTRIC POWER SUPPLY AND NATIONAL SECURITY. A STUDY IN PUBLIC POLICY (thesis). Benjamin S. Loeb. 1959. 213p. OTS.

A discussion of the effects of the electrical power supply on the national security of the U. S. during wartime is presented. The effects of a modern war on electricity requirements and supply are discussed. Suggested modes of action for power supply preparedness are given. (C.J.G.)

21184 CEA-1432
France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucleaires, Saclay.
QUANTITE ET ACTIVITE DES PRODUITS DE FISSION OBTENUS EN FRANCE DANS LES ANNEES A VENIR COMPTE TENU DU DEVELOPPEMENT DE L'ENERGIE ATOMIQUE. (Amount and Activity of Fission Products which will be Obtainable in France in the Immediate Future Taking into Account the Development of Atomic Energy). J. Guirlet and J. M. Lavie. 1960. 20p.

By using the Wigner and Way formula, the activity of the complex mixture of fission products produced in a pile may be estimated theoretically. This study was carried out on the basis of forecasts, in the case of France, for the production of electricity of atomic origin to 1975. The uranium was assumed to be in the pile during periods of three months and six months. It is possible to find the activity of a particular fission product and to give its decay rate. The element chosen is strontium for a three months' period. Each set of curves gives at any moment the total activity accumulated, and the characteristic activity of the fission products corresponding to a given half life. (auth)

21185 ERDL-1625-TR
Army Engineer Research and Development Labs., Fort Belvoir, Va.
HIGH EXPLOSIVE EQUIVALENCE FOR UNDERGROUND DETONATION OF OPERATION PLUMBBOB. O. Kirk Ehlers, Fredrick A. Pieper, and Arthur C. Tiemann. Apr. 26, 1960. 25p. OTS.

Results are reported from a test to determine the percent of high explosive (HE) energy equivalence of the RANIER Shot of Operation PLUMBBOB. Determination was made by duplicating strong motion measurements of RANIER for a relatively small-scale HE detonation under carefully controlled conditions. The principal strong motion measurements made included acceleration, pressure, and strain. All measurements were made in the free field. In addition, pre- and post-shot, permanent-displacement-measurement surveys were made. A standardized method was developed using HE charges to determine effects to be expected from detonation of deep underground nuclear explosions in media other than that found in the RANIER test area. (auth)

21186 NP-8898
European Organization for Nuclear Research, Geneva.
ANNUAL REPORT [FOR] 1959. 90p.

An account of CERN's activities in 1959, which was dominated by the commissioning of the 25 Bev proton synchrotron, is given. Progress and structure of CERN, activities of the Directorate-General's office, theoretical studies, proton synchrotron, synchrocyclotron, scientific and technical services, site and buildings, and administration are summarized. (W.D.M.)

21187 SC-4823(RR)
Sandia Corp., Albuquerque, N. Mex. and California. Univ., Livermore. Lawrence Radiation Lab.
HIGH EXPLOSIVES, ARMING, AND SYSTEMATICS. Final Report [of] Project COWBOY. Lyle Hake. June 30, 1960. 43p. OTS.

Project Cowboy was a series of tests to determine whether exploding a high-explosive charge in the center of an underground sphere would produce seismic decoupling (relatively little of explosion energy is translated into earth motion) of the resulting shock wave. The tests were conducted in a salt mine at 800 ft below ground in two spherical rooms 12 and 30 ft in diam. The explosive used was duPont Pelletol 1. Descriptions of the safety and firing procedures are given. (C.J.G.)

21188 UCRL-5990
California. Univ., Livermore. Lawrence Radiation Lab.
DENSITIES AND VELOCITIES MEASURED ON SPECIMENS FROM INSTRUMENT AND SHOT HOLES. Raymond S. Guido and Stanley E. Warner. May 2, 1960. 17p. Project HOBO. Contract W-7405-eng-48. OTS.

Results are given for bulk-density and pulse-velocity measurements performed on specimens of the Project Hobo medium. Test techniques, sample handling, and specimen preparation are described. Values are tabu-

lated in terms of sample origin and geological identity. (auth)

21189 WT-306

Sandia Corp., Albuquerque, N. Mex.

FREE AIR PRESSURE MEASUREMENTS. W. J. Howard and R. D. Jones. Feb. 19, 1952. Decl. Feb. 25, 1960. 29p. Project 1.4 [of] Operation Jangle. OTS.

Indenter gages, Wiancko gages, and interferometer gages were used to measure air overpressure vs time at essentially ground level stations for both the surface (S) and underground (U) atomic explosions. For the S Burst several instruments were placed on a line extending from an overpressure region of 13 psi to a region of less than one psi. The air measurements for the U Burst ranged from 32 to 2 psi. (D.L.G.)

21190 WT-323

Ballistic Research Labs., Aberdeen Proving Grounds, Md.

PEAK AIR BLAST PRESSURES FROM SHOCK VELOCITY MEASUREMENTS ALONG THE GROUND. Robert A. Eberhard, Charles N. Kingery, and Walter F. Molesky. [195?]. 56p. Project 1.2a-1 [of] OPERATION JANGLE. OTS.

The peak air pressure along the ground was determined by measurement of the air blast velocity for the surface (S) and underground (U) nuclear explosions at the Nevada Test. Preliminary HE tests were made to correlate use of scaling laws and to check instrumentation procedures. Velocities were calculated using pre-determined distances and the measurement of arrival times of the shock wave at those distances. Pressures were calculated from a pressure-velocity equation derived from the Rankine-Hugoniot relations based on the conservation of mass, momentum, and energy across the shock front and from the ideal gas law for computing the internal energy of a gas. Equivalent TNT blast tonnages for the S and U Bursts were found to be 1 ± 0.05 kt and 1 ± 0.26 kt respectively. The pressure vs reduced distance curve obtained from the S Burst coincided with the free air curve, and the curve for the U Burst compared favorably with the curves from the HE tests. (D.L.C.)

21191 WT-324

Brookhaven National Lab., Upton, N. Y.

FREE AIR SHOCK ARRIVAL TIMES. S. Rankowitz, R. L. Chase, and J. B. H. Kuper. May 23, 1952. Decl. Feb. 25, 1960. 32p. Project 1.3a [of] OPERATION JANGLE. OTS.

The time of arrival of shock waves was measured at two points in free air. An attempt was made also to measure the peak overpressure at the same two points. The points were ~800 and 1200 ft from ground zero, at altitudes of 400 and 600 ft respectively. A combination of blast switches and pressure pickups was used, and the information was telemetered to a manned recording station. Oscilloscope photography and tape recordings were used to provide accurate time measurements and pressure indications. The equipment was suspended from balloons, and photography was used to determine the location of the pickups at the time of arrival of the wave. Arrival time information was obtained from both types of pickups at the 1200-ft station. The corrected arrival times are 12 to 16% shorter than those using gages near the ground. The pressure gages appeared to be so variable that little confidence can be placed in their readings. (D.L.C.)

21192 WT-325

Air Force Cambridge Research Center. Terrestrial Sciences Lab., Mass.

THE MEASUREMENT OF FREE AIR ATOMIC BLAST PRESSURES. Norman A. Haskell and James O. Vann. Apr. 10, 1952. Decl. Feb. 25, 1960. 59p. Project 1.3C [of] OPERATION JANGLE. OTS.

Free air peak pressure was measured as a function of time and space. Eight instrumented parachute-borne canisters were positioned from 2000 to 29,000 ft vertically above ground zero. Each canister contained an altimeter transducer, two differential pressure transducers, a radio telemetry transmitter, and a radio tracking beacon. The operation was a preliminary test of equipment and techniques. The positions actually attained by the canisters were inconsistent with the intended vertical array and did not provide an accurate test of the Fuchs altitude correction. There is justification for concluding that the data obtained supported the Fuchs theory within the probable accuracy of the observations up to overpressures of 0.1 psi. (D.L.C.)

21193 WT-326

David Taylor Model Basis, [Carderock, Md.].

DETECTION OF TIME OF ARRIVAL OF FIRST EARTH MOTION. George W. Cook and W. P. Kiley. Apr. 1, 1952. Decl. Feb. 25, 1960. 16p. Project 1.5b [of] OPERATION JANGLE. OTS.

Measurements were made on the arrival time of the first detectable earth motion at each of ten stations located between 100 and 600 ft from ground zero. The instrumentation consisted of seismic detectors which triggered electronic flash lamps; the time sequence of the lamp flashes was recorded photographically from a remote camera station. The data obtained shows the time of arrival at Station 1 (100 ft) to be 26.6 msec and to increase somewhat linearly to 134 msec at Station 10 (542 ft). The data are presented in both tabular and graphical form, and the instrumentation and methods developed to carry out the measurements are discussed. (auth)

21194 WT-353

Corp of Engineers. Ohio River Div. Labs., Mariemount, Ohio.

EARTH DISPLACEMENT (SHEAR SHAFTS). Apr. 1952. Decl. Feb. 25, 1960. 33p. Project 1.6 [of] OPERATION JANGLE. OTS.

No significant permanent movement, either vertically or radially, was observed for any of the shafts in the surface shot area. In the underground shot area, definite and significant movements were observed only for the two innermost shafts at 250 ft and 312.5 ft on the main (south) blast line, each shaft being displaced radially outward less than a foot at the ground surface. Vertical movements of the tops of the shafts at these same locations were considerably less and of the order of 0.75 to 1.5 in. downward. The horizontal and vertical movements observed were due principally to rotation and translation of the top five foot segment of pipe and should not be interpreted as applicable to the entire shaft as a unit. For the conditions and locations in effect in these tests, it appears that major permanent displacements will not extend beyond approximately two and three lambda for surface and shallow underground shots, respectively, except for possible local disturbances very near the ground surface. There is considerable asymmetry in permanent displacements about ground zero in the underground tests. (auth)

21195 WT-364

Sandia Corp., Albuquerque, N. Mex.

CLOSE IN GROUND MEASUREMENTS. William F. Gannon. Mar. 1952. Decl. Feb. 25, 1960. 32p. Project 1.2b [of] OPERATION JANGLE. OTS.

The rate of progression of the underground wave, rate of expansion of the fireball, and the point of breakaway of the

shock front from the fireball were determined for the Jangle Underground Burst. The two methods which were used were the normally closed thyratron switch and the normally open thyratron switch. The results of the close-in ground measurements showed that, for the first few feet, there was a very large expansion with a velocity of the order of 10^5 fps. From 25 to 100 ft, the velocity was ~2700 fps. During the second hundred ft the average velocity was reduced to 2500 fps. Beyond 200 ft, the velocity increased to more than 4000 fps. The tests have definitely proved that the velocity of a shock wave traveling through the earth can be measured by using a closed-diaphram switch in conjunction with a thyratron-pulsing circuit. The electronic chronograph which was used is subject to improvement. (D.L.C.)

21196 WT-377
Stanford Research Inst., [Menlo Park], Calif.
SCALED HE TESTS. E. B. Doll and V. Salmon. Apr. 1952. Decl. Feb. 25, 1960. 124p. Project 1(9)-1 [of] OPERATION JANGLE. OTS.

Four high-explosive (HE) tests were conducted at the Nevada Proving Grounds in order to provide information for scaled predictions for shallow underground and surface nuclear tests. In general, the air blast scaled as predicted in both duration and amplitude. The sharp and highly damped oscillation acceleration due to air blast scaled as did air-blast pressure, but its period increased less rapidly than the scale factor. Particle velocity and permanent displacement did not scale well enough to permit predictions. Air-coupled phenomena were prominent due to the relatively shallow scaled charge depths and appeared to predominate in earth accelerations at large distances. A comparison with Dugway results (for dry clay) from similar tests indicates that the earth-acceleration amplitudes and durations were approximately inverse to each other for the two soils, with Dugway amplitudes considerably less than for the Jangle HE program. (D.L.C.)

21197 WT-380
Stanford Research Inst., [Menlo Park], Calif.
GROUND ACCELERATION, GROUND AND AIR PRESSURES FOR UNDERGROUND TEST. E. B. Doll and V. Salmon. Apr. 1952. Decl. Feb. 25, 1960. 91p. Project 1(9)A of OPERATION JANGLE. OTS.

Measurements of earth accelerations, earth pressures, and air-blast pressures were made on the underground burst at Operation Jangle. These measurements were taken on a blast line which was 90° removed from the major blast line, and gages of the variable-reluctance type were used. Comparisons were made between the results and the predictions made in the report WT-377. For air pressure, the nuclear charge was found to be equivalent to about a 0.85-kt charge of TNT. In almost every oase, the earth phenomena results indicated an energy equivalence less than 1.0-kt of TNT. The earth phenomena were found to be a combination of air-induced and direct-earth effects. Some rough integrations of the horizontal earth accelerations, yielding particle velocities, are presented and discussed. A brief discussion of damage criteria in relation to surface structures is included in the report. (D.L.C.)

21198 WT-382
Naval Ordnance Lab., White Oak, Md.
TRANSIENT GROUND DISPLACEMENT MEASUREMENT. W. E. Morris. [195?]. Decl. Feb. 25, 1960. 13p. Project 1.5a [of] OPERATION JANGLE. OTS.

An attempt was made to measure the transient ground displacement for the surface and underground shots of Operation Jangle. The method of high-speed photography of the ground motion is described. Negative results were obtained for both the surface and underground shots. This method does not appear promising for any future nuclear surface tests. With good photography, this method has considerable promise for underground nuclear explosions and is recommended for future tests. (auth)

21199 WT-385
Ballistic Research Labs., Aberdeen Proving Ground, Md.
TRANSIENT GROUND MECHANICAL EFFECTS FROM HE AND NUCLEAR EXPLOSIONS. Thomas J. Andrews, Edward J. Bryant, Paul H. Lorrain, and Nicholas M. Masich. June 1952. Decl. Feb. 25, 1960. 59p. Project 1.2a-2 [of] OPERATION JANGLE. OTS.

Ground accelerations and pressures resulting from a surface nuclear detonation at a scaled charged height of 0.024, from an underground burst at a scaled burial depth of 0.135, and from two underground HE detonations of different weights at a scaled burial depth of 0.15, were determined as functions of a reduced distance. The maximum horizontal and vertical ground accelerations were of approximately the same magnitude for each of the detonations. Some correlation between the laws of attenuation of ground accelerations was found to exist between the underground nuclear detonation and the underground HE explosion of 40,000 lb. A comparison of the data from the three shots indicated that ground pressure data from small charges may not be accurately applied to nuclear charges by scaling laws now in use. Maximum ground pressures occurring from the detonation of nuclear charges described in this report were primarily due to air blast effects on the ground surface. The apparatus used, accelerometers and pressure gages, are described. (D.L.C.)

21200 WT-388
Naval Ordnance Lab., White Oak, Md.
GROUND ACCELERATION MEASUREMENTS. W. E. Morris. June 1952. Decl. Feb. 25, 1960. 275p. Project 1.1 [of] OPERATION JANGLE. OTS.

Ground acceleration from nuclear detonations on the surface and underground were measured in the vertical, radial, and transverse directions at various distances. The propagation, effect of depth, frequency characteristics, and attenuation of the ground acceleration are discussed. It was found that when the high frequency transient air blast acceleration is considered, the surface shot is more effective in producing maximum acceleration; when the air blast effect is excluded and only the fundamental type acceleration is considered, the underground shot is more effective. These results scaled reasonably well with the 40,000-lb TNT charge detonated at the site. A new type inductance type accelerometer and recording system are described. (D.L.C.)

21201 WT-389
Naval Ordnance Lab., White Oak, Md.
PEAK PRESSURE VS DISTANCE IN FREE AIR USING SMOKE-ROCKET PHOTOGRAPHY. J. F. Moulton, E. R. Walthall, and P. Hanlon. June 1952. Decl. Feb. 25, 1960. 50p. Project 1.3b [of] OPERATION JANGLE. OTS.

The objective of the experiment was to obtain accurate information for the evaluation of the peak overpressure in the shock wave as a function of distance radially along the ground and vertically above the event. The method employed was that of establishing a smoke rocket trail grid, high-speed photographs of which showed the time of arrival of the shock front at a measurable distance in the desired directions. Despite the total loss of timing records for the surface shot, a time base was established using the time of arrival results reported in WT-323. Peak overpres-

sures were calculated only in the vertical direction for this event, since pressures along the ground would be identical to those of WT-323. Peak overpressures, both along the ground and vertically, were determined for the underground burst. (D.L.C.)

21202 WT-390

Naval Ordnance Lab., White Oak, Md.

BASE SURGE ANALYSIS FOR NUCLEAR TESTS. George A. Young and Mary L. Milligan. June 5, 1952. Decl. Feb. 25, 1960. 26p. Project 1(9)b of OPERATION JANGLE. OTS.

Base surge and related phenomena produced by the underground burst are presented and compared with TNT results. Empirical formulas which show the effect of charge weight on the column and jet are listed, and a method of scaling base surge flow for various charge weights and depths is presented. Data on the underground burst indicate that column size can be predicted on the basis of TNT measurements but that overall cloud heights do not scale because of the thermal energy of the fireball. Froude scaling of the Jangle base surge data shows a slower rate of growth and a smaller extent than the surges formed by scaled TNT explosions. A method is presented for predicting the rate of growth and maximum extent of base surges formed by atomic weapons with different energies than the Jangle underground Burst, but scaled to the same depth. The cloud phenomena formed by the surface burst are described briefly and compared with TNT results. (D.L.C.)

21203 WT-399

Naval Civil Engineering Research and Evaluating Lab., Port Hueneme, Calif.

PHYSICAL CHARACTERISTICS OF CRATER AND LIP. J. A. Bishop and F. E. Lowance. May 1952. Dec. Feb. 25, 1960. 27p. Project 4.2 [of] OPERATION JANGLE. OTS.

A study was made to determine the physical dimensions of the craters and lips resulting from the surface (S) and underground (U) explosions. Soil samples were taken to establish the characteristics and properties of the soil within the anticipated U burst crater area. Topographic surveys were made before and after the blast of the areas surrounding the zero points and the quantities of earth moved were estimated. An attempt was made to establish the true crater depth resulting from the U burst by measuring the amount of radioactive contamination obtained from the surface to a depth of two feet. The maximum depth of the U burst crater was ~53 ft and the width was ~258 ft. The maximum height of the lip above original ground surface was 8 ft. The S burst crater was ~17 ft in depth and the lip 5 ft above original ground surface. The width of the crater was ~90 ft. A radioactive gradient in the soil on the sides and in the bottom of the crater of the U burst was plotted. (D.L.C.)

21204 WT-410

Armed Forces Special Weapons Project, Washington, D. C.

SOME HE TESTS AND OBSERVATIONS ON CRATERS AND BASE SURGES. Donald C. Campbell. Nov. 1, 1951. Decl. Feb. 25, 1960. 64p. Project 1(9)–3 [of] OPERATION JANGLE. OTS.

Ten HE shots were conducted in the upper Yucca Flat and Frenchman Flat areas in order to obtain data for predictions concerning the phenomena to be studied during Jangle Operation. The HE data indicated that for the Jangle surface burst a base surge would be unlikely, and the maximum altitude of the cloud would be ~12,000 ft. The data also indicated that the Jangle underground burst would have considerable throw-out at the base of plume, and the base surge, if any, would be small. Since the crater diameter is a readily scaled parameter for underground TNT explosions, then the immediate observation of the underground crater diameter would be a simple method for determining the equivalent TNT yield of the nuclear weapon. Estimated dimensions of the craters and lips of the Jangle S and U Bursts are given. (D.L.C.)

21205

NUCLEAR POWER IN OUTER SPACE. William R. Corliss (Martin Co., Baltimore). Nucleonics 18, No. 8, 58-63(1960) Aug.

The potentialities of various power plants were investigated for the production of electric power in outer space. Emphasis was placed on nuclear energy, but comparison was made with other types, chemical and solar. Regardless of the utilization of chemical fuel, its energy density relegates it to the very short time part of the power duration plane. Solar energy is free except for the specific mass penalties of the collector. Solar plants can provide long-term power at specific masses that are highly competitive with nuclear power to a power level of 50 kw(e). The real promise of nuclear power is in the long term, high power range where it is uncontested by chemicals and solar power. Radioisotopes are important energy sources below 5 kw(e) with fission power plants dominant at higher levels. As continuing research pushes back the temperature and specific mass barriers, nuclear power is expected to keep pace with ever-increasing demands of space technology for more power in lighter and more compact packages. (B.O.G.)

21206

RESPONSIBILITIES OF THE DIVISION OF BIOLOGY AND MEDICINE IN THE U. S. ATOMIC ENERGY PROGRAM. Charles L. Dunham (U. S. Atomic Energy Commission, Washington, D. C.). p.39-45 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

The organization and responsibilities of the Division of Biology and Medicine in the United States atomic energy program are outlined. (C.H.)

21207

SCIENTIFIC PROGRESS AND THE DEVELOPMENT AND PROSPERITY OF THE AMERICAS. Bernardo A. Houssay (Univ. of Buenos Aires). p.83-9 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Science and technology are declared to be the basis of the wealth and prosperity of peoples. The importance is stressed of the development of both basic and applied science. The need for education and training in the sciences in Latin American countries is discussed. (C.H.)

21208

NUCLEAR TRAINING AND EDUCATION IN THE AMERICAS. Jesse D. Perkinson, Jr. (Inter-American Nuclear Energy Commission, Washington, D. C.). p.91-4 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

The organization of nuclear training and education in the Americas is discussed. Training available in the use of radiation and radioisotopes is outlined. Examples of the kinds of radioisotope instruction that exist in the Americas are discussed in detail. (C.H.)

21209

UTILIZATION OF ATOMIC ENERGY SCIENTIFIC AND TECHNICAL INFORMATION. Melvin S. Day (U. S. Atomic Energy Commission, Washington, D. C.). p.95-9 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

The U. S. Atomic Energy Commission is dedicated to a program of supporting the interchange of scientific information among the American Republics. The key to the atomic energy literature is Nuclear Science Abstracts, a semimonthly abstract journal which serves the world's scientific and engineering community by providing abstracts of literature on nuclear science and technology. Other means of presenting information include Quarterly Technical Progress Reviews in specific subject areas, bibliographies within specific subject areas, engineering drawings, depository libraries, and a program of information exchange. (C.H.)

21210

International Atomic Energy Agency, Vienna.
LIST OF BIBLIOGRAPHIES ON NUCLEAR ENERGY. Volume 1, Number 1, June 1960. 26p.

A list of bibliographies on nuclear energy recently published, in preparation, or planned is presented in order to enable duplication of effort to be avoided and as a means of disseminating information. Entries are classified according to subject and subdivided into bibliographies published and bibliographies in preparation. Under these subdivisions the entries are arranged by title in alphabetical order. (M.C.G.)

21211

IMPROVEMENTS IN SUBTERRANEAN NUCLEAR EXPLOSIONS. P.M.C.M. Rougeron. French Patent 1,194,164. May 5, 1959.

It is suggested to let a non-military nuclear explosion take place in an evacuated subterranean space, created by digging or by a preliminary explosion. It is stated that due to the evacuation, less nuclear energy is mechanically wasted in the form of shock waves. Thus, the thermal output of the explosion is increased whereas subterranean destruction is decreased.

BIOLOGY AND MEDICINE

General and Miscellaneous

21212 A/AC.82/G/L.358
National Academy of Sciences.
THE BIOLOGICAL EFFECTS OF ATOMIC RADIATION. Summary Reports from a Study by the National Academy of Sciences. 1960. 100p.

Summary reports are presented which cover the findings and recommendations of six committees established to study the biological effects of atomic radiations. Topics discussed include the genetic effects of radiation, pathological effects of radiation, the meteorological aspects of world-wide fall-out, radiation in agricultural research and applications in agricultural projects and food processing, the disposal and dispersal of radioactive wastes, and applications of radiation in oceanography and investigations of fisheries. (C.H.)

21213 BLG-48
Brussels. Centre d'Étude de l'Énergie Nucléaire.
ANALYSE DES TECHNIQUES EN AUTORADIOGRAPHIE DE COUPES HISTOLOGIQUES. (Analysis of Autoradiographic Techniques of Histological Sections). R. Delsa and R. Sour. May 16, 1960. 12p.

Methods used in autoradiography such as the contact method, coating with liquid emulsion, and stripping-film are analyzed. The manipulations proper to each of these methods are described. (auth)

21214 JPRS-5030
MEDICAL RADIOLOGY. Translation of Meditsinskaya Radiologiya Volume V, No. 1, 1960. 243p. OTS.

21215 JPRS-5030(p.122-6)
APPLICATION OF THE SCANNING METHOD FOR PRECISION IN LOCALIZATION OF A SPINAL CORD TUMOR. F. M. Lyass and B. I. Smagin. Translated from Med. Radiol. 5, No. 1, 51-2(1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8340.

21216

STRONTIUM–CALCIUM INTERRELATIONSHIPS IN THE MATURE RAT. Roy C. Thompson and Ray F. Palmer (General Electric Co., Richland, Wash.). Am. J. Physiol. 199, 94-102(1960) July.

The comparative metabolic behavior of strontium and calcium was studied in mature, female rats exposed both chronically and acutely to Sr^{90} and Ca^{45}, while on diets of various total calcium contents. When orally administered, there is a discrimination against Sr^{90} relative to Ca^{45}, apparent in the isotope levels in both blood and bone. This discrimination becomes smaller in magnitude as the level of calcium intake is increased. On all levels of calcium intake there is extensive exchange of calcium and strontium between bone and blood. On low-calcium diets the calcium moving from bone to blood is almost completely reutilized; as the level of dietary calcium is increased, this reutilization becomes less efficient and the rate of net removal of calcium from bone increases. In contrast, the rate of net removal of strontium from bone was relatively insensitive to changes in dietary calcium level, and on all diets was similar to the rate of net removal of calcium on the highest calcium diet. (auth)

21217

LOW-TEMPERATURE PREPARATION TECHNIQUES FOR ELECTRON MICROSCOPY OF BIOLOGICAL SPECIMENS BASED ON RAPID FREEZING WITH LIQUID HELIUM II. Humberto Fernández-Morán (Massachusetts General Hospital, Boston and Massachusetts Inst. of Tech., Cambridge). Ann. N. Y. Acad. Sci. 85, 689-713(1960) Apr. 13.

Low-temperature preparation techniques are described which are reported to give better morphologic and cytochemical preservation of biological specimens than do the standard freeze-drying and freeze-substitution methods. (C.H.)

21218

RADIOCHEMICAL PURITY OF β-SITOSTEROLS TRITIATED BY CATALYTIC EXCHANGE AND BY THE WILZBACH PROCEDURE. Harold Werbin, I. L. Chaikoff, and Miles R. Imada (Univ. of California, Berkeley). Arch. Biochem. Biophys. 89, 213-17(1960) Aug.

Tritiation of commercial β-sitosterol by the Wilzbach procedure resulted in partial reduction (10%) of the double bond of this sterol. The dihydrositosterol contained 60% of the total H^3 of the tritiated sample. Tritiation of β-sitosterol by catalytic exchange, however, resulted in negligible reduction of the double bond. The epoxide derivatives of β-sitosterol, which are easily prepared, are

useful in establishing the radiochemical purity of tritiated β-sitosterol. The α, β, and 1:1 (α + β) molecular complex of sitosterol epoxide acetates were separated and characterized. Three commercial, unlabeled samples of β-sitosterol were found to contain from 4 to 14% dihydrositosterol (β-sitostanol). (auth)

21219

THE RaD CONTENT OF PLANTS OBTAINED BY A γ SPECTROSCOPIC METHOD. K. J. Godt and K. Sommermeyer (Universität Freiburg/Breisgau, Ger.). Atomkernenergie 5, 282-5(1960) July-Aug. (In German)

The various kinds of radioactive compounds in plants are not only of interest from the science point of view but its knowledge is also required for critical judgment of questions regarding radiation protection. The RaD-content in plants, after all, is quite considerable as it can be measured by gamma-spectrographical methods, whereby the 46.5 kev-line can be regarded as proof. (auth)

21220

TREATMENT OF CARCINOMA OF THE BLADDER. A SYMPOSIUM. I. TREATMENT BY INTERSTITIAL IRRADIATION USING TANTALUM 182 WIRE. H. J. G. Bloom (Royal Marsden Hospital, London). Brit. J. Radiol. 33, 471-9(1960) Aug.

Procedures and results are described for approximately 250 cases of carcinoma of the bladder treated by interstitial irradiation using tantalum-182 wire. (C.H.)

21221

COMPARISON OF RADIOCARDIOGRAPHIC TRACINGS RECORDED SIMULTANEOUSLY FROM TWO SCINTILLATORS PLACED TOGETHER IN DIFFERENT POSITIONS ON THE CHEST. G. Fumagalli and F. Di Pietrantonj (Università, Genoa). Minerva nucleare 4, 142-6(1960) May. (In Italian)

Radiocardiographic tracings obtained by means of two scintillation counters placed in two orthogonal positions on the chest revealed significant differences with respect to the R and L slopes and the P/V ratio, whereas no significant difference was observed as regards the TCM. (auth)

21222

SUSTAINED ACTION OF INJECTED CHELATING AGENTS. A. Lindenbaum and J. Schubert (Argonne National Lab., Ill.). Nature 187, 575-6(1960) Aug. 13.

Low-pressure ultrafiltration techniques were used to study the unusual effects of ethylenediaminetetraacetic (EDTA) and diethylenetriaminepentaacetic (DTPA) acids on the elimination of radioactive metals from animals. The Ca salt of DTPA was injected into rats 3 days after an injection of Pu^{239}, and the ultrafilterability of Pu from the bone, liver, and plasma was measured after killing the rats at intervals of 1, 2, 3, and 7 days after injection. The results show that the diffusibility of Pu remains > 10x greater than that of control animals for at least 7 days. DTPA was compared with EDTA by addition to blood samples taken from rats 15 min after Pu injection; at chelate concentrations of 10^{-6} to 10^{-5} M, DTPA was found to be more effective in increasing the % ultrafiltered Pu. The ultrafiltration of Sr in blood was also studied and found to be identical with that of controls up to 2×10^{-2} M EDTA, a concentration unattainable in the blood of living animals. Experiments similar to those with Pu were made with Th^{234} and gave similar results, DTPA again being superior to EDTA. (D.L.C.)

21223

UPTAKE OF THYMIDINE AND SYNTHESIS OF DEOXYRIBONUCLEIC ACID IN MOUSE ASCITES CELLS. A. R. Crathorn and K. V. Shooter (Royal Cancer Hospital, London). Nature 187, 614-15(1960) Aug. 13.

The uptake of tritium-labelled thymidine by mouse Ehrlich and Landschutz ascites cells in vitro was studied by measuring the activity present in the cell and incorporated into desoxyribonucleic acid (DNA) as a function of time. The distribution of the precursor among the cells was determined by autoradiography. The results show that thymidine is rapidly taken up by cells, but the incorporation rate in DNA is much slower. The precursor studies indicate that the tritium activity is 15% thymidine di- and tri-phosphates, 25% thymidine monophosphate, and 60% thymidine. The assumption that the activity left in the nucleus after washing and fixing is due to thymidine incorporated into DNA is shown to be invalid; precursors are left behind as well as DNA, and the average activity per cell is about the same for both the two incubation periods and has no relationship to the DNA activity. (D.L.C.)

21224

PRINCIPLES GOVERNING THE DEVELOPMENT OF OSTEOGENIC SARCOMA INDUCED BY RADIOACTIVE ISOTOPES. V. N. Strel'tsova (Academy of Medical Sciences, USSR). Problems of Oncol. (U.S.S.R.)(English Translation) 5, No. 8, 1-12(1959).

Administration of Sr^{89}, Sr^{90}, Sr^{89} + Sr^{90}, Y^{90}, Y^{91}, Ba^{140}, Pu^{239}, Ce^{144}, and Pm^{147}, as well as solutions of fission products of uranium in doses of 0.005 to 3.0 μc/g (rats) and 0.2 to 1.5 μc/g (rabbits), leads to the development of osteosarcoma in animals surviving for more than 200 days. The time of survival of animals with bone tumors and the frequency of metastasis formation are inversely proportional to the dose. Sex has no influence upon the frequency of development of malignant bone tumors. The size and capacity of the dose received by the bone tissue is of decisive importance for the formation of osteosarcoma. Malignant bone tumors develop in rats and in rabbits after the same period of time. Multiple growth of osteosarcoma occurs more frequently in rabbits than in rats and the formation of metastases is more frequent and more abundant in rabbits. (auth)

21225

IRRADIATION OF THE INTESTINE BY RADIOISOTOPES. M. F. Sullivan, P. L. Hackett, L. A. George, and R. C. Thompson (General Electric Co., Richland, Wash.). Radiation Research 13, 343-55(1960) Aug.

The LD_{50} for orally administered Y^{91} in the rat is about 17 mc/kg, and the average survival time is 8.4 days. The calculated radiation dose from this amount of yttrium to the various segments of the intestine was determined. Blood counts showed that lymphocytopenia, granulocytosis, and a mild anemia occurred after oral doses of Y^{91}. Fluid loss and hemorrhage were contributing factors to these changes. Pathologic changes due to Y^{91} were primarily present in the large intestine owing to longer retention of intestinal contents in that segment. Damage was qualitatively similar to that observed previously after x irradiation. Quantities as high as 230 mc/kg of the α-emitting isotope Pu^{239} were administered by gavage to rats without causing death. A series of rats sacrificed at 3, 6, and 9 days showed only superficial epithelial damage at 3 days. No other evidence of injury was noted. (auth)

21226

LUNG HOMOGRAFT ACCEPTANCE AND HETEROGRAFT REJECTION BY LATE HOMOLOGOUS RADIATION CHIMERAS. L. J. Cole, W. E. Davis, R. M. Garver, and V. J. Rosen, Jr. (U. S. Naval Radiological Defense Lab.,

San Francisco). Transplantation Bull. 26, 142-5(1960) July.

Long-lived homologous bone marrow mouse chimeras were found to accept lung grafts of both donor and host origin but to reject rat lung grafts. The hosts were irradiated prior to injection. Data are tabulated on the fate of lung homografts and heterografts in homologous chimeras. (C.H.)

21227

Inter-American Nuclear Energy Commission, Washington, D. C. and Argentina. Comisión Nacional de Energía Atómica, Buenos Aires.

RADIOISOTOPES AND RADIATION IN THE LIFE SCIENCES. 2ND INTER-AMERICAN SYMPOSIUM ON THE PEACEFUL APPLICATION OF NUCLEAR ENERGY, BUENOS AIRES, 1959. 1960. 275p.

Separate abstracts were prepared on 36 papers presented at this symposium. (C.H.)

21228

STUDIES OF BONE MARROW METABOLISM WITH CARBON 14. John R. Totter (Univ. of Montevideo). p.11-13 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Results are reviewed from studies of bone marrow metabolism in rabbits and rats in which carbon-14 was used as a tracer. (C.H.)

21229

DISTRIBUTION IN RAT TISSUE OF COLLOIDAL HYDROXYCITRATE OF RADIOACTIVE YTTRIUM. A STUDY OF THE FUNCTION OF THE RETICULO-ENDOTHELIAL SYSTEM. Veronica Rapp De Eston and Tede Eston De Eston (Univ. of São Paulo, Brazil). p.15-28 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Yttrium-91 hydroxycitrate was used as a tracer in studies on the function of the reticulo-endothelial system. Results indicate that particles are subject to continuous transference and excretion after they enter the body and that liver, spleen, and bone are the most active tissues in the fixation of yttrium hydroxycitrate. It was demonstrated that the phagocytic activity of the cells of the reticulo-endothelial system is influenced by the size of the particles, by the concentration, and by the chemical nature of the substance injected intravenously. (C.H.)

21230

PATHWAY FOR WATER-DIFFUSION IN THE GIANT NERVE FIBER OF THE SQUID. Raimundo Villegas and Gloria M. Villegas (Venezuelan Inst. of Scientific Research, Caracas). p.77-81 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Results are reported from studies of the relation between nerve structure and water diffusion permeability coefficient in the giant nerve fiber of the squid. (C.H.)

21231

STUDIES ON THE METABOLISM OF IODINE IN ENDEMIC GOITER. Marcel Roche (Instituto Venezolano de Investigaciones Científicas, Caracas). p.111-14 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Results are reviewed from studies carried out in Venezuela on the metabolism of iodine in endemic goiter. In four regions of the country the uptake of iodine-131 was found to increase in direct proportion to the incidence of goiter. The great thyroid avidity in endemic goiter is in accordance with the theory that implies that the lack of iodine is an important factor in its production. It is also concluded that lack of iodine is not the only factor involved in the production of goiter. (C.H.)

21232

RADIOACTIVE IODINE IN THYROID GLAND STUDIES. Jose Barzelatto (Univ. of Chile, Santiago). p.115-19 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Experiences with the use of radioactive iodine in over 8,000 examinations of the thyroid are reviewed. The studies were made in a country where endemic goiter is widespread owing to iodine deficiency. Data are included from studies on the effects of tri-iodothyronine on thyroid concentration of radioactive iodine in various thyroid conditions and pregnancy. A condition of hyperthyroidism was found to exist in twin pregnancy and patients with hydatidform moles. (C.H.)

21233

IODINE METABOLISM IN A REGION WHERE GOITER OCCURS BECAUSE OF LACK OF IODINE. Hector Perinetti (Univ. of Cuyo, Mendoza, Argentina). p.121-30 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Results are reported from studies on iodine metabolism in inhabitants of a region where endemic goiter has occurred for two centuries. The distribution of iodine-131 in body tissues was measured. Results are discussed. (C.H.)

21234

THYROGRAM STUDIES OF NODULAR GOITERS. Luiz Carlos Lobo, Jayme Rodrigues, and J. P. Guimaraes (Univ. of Brazil, Rio de Janeiro). p. 131-5 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Of 138 nodular goiter patients studied, 107 showed solitary nodules and 31 showed multinodular goiters. A relationship was sought between the thyrogram and the clinical and complementary findings. Surgery was performed on 30 patients, of whom 23 had solitary nodules and 7 multinodular goiter. Malignant growths were found in 17.7% of the solitary nonfunctioning nodules. All the cancerous nodules were immobile and inelastic. The number of carcinomas observed equaled 3% of the total uninodular goiter cases. The thyrogram is viewed as a fundamental tool for the selection of nodules for surgery. (auth)

21235

ABSORPTION OF RADIOISOTOPES THROUGH THE BILE DUCT IN MAN AND DOG. M. A. Patetta-Queirolo, H. Cosco-Montaldo, and V. H. Gonzalez-Panizza (Univ. of Montevideo). p.137-42 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Studies of the absorption of tracer amounts of radioactive iodine and radioactive phosphorus through the bile ducts were made in seven patients and 18 dogs. The bile duct absorption curves were compared with those achieved with other methods of administration (intravenous, in-

traduodenal, and intraperitoneal). In some cases the radioisotopes were injected into the gall bladder, blocked by ligature of the cystic duct. When P^{32} was used, blood and urine were studied after injection. When I^{131} was used, thyroid uptake was studied by comparing direct uptake with indirect uptake. It was possible in all cases to find a representative absorption equation in line with the experimental results. The absorption rate achieved with bile duct administration was 5% per minute of the maximum value, as against 11% for the duodenal, and 3% for the peritoneal. Attention is called to the high rate for biliary absorption and to its importance to the physiopathology of infected bile ducts. (auth)

21236

DNP AND CELL METABOLISM. A. O. M. Stoppani (Univ. of Buenos Aires and Comisión Nacional de Energía Atómica, Buenos Aires). p.143-6 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

It was shown that 2:4-dinitrophenol in small concentrations inhibits the oxidation of acetate, acetaldehyde, and pyruvate by yeast. The inhibition is selective with respect to the substrates, since the oxidation of glucose, the dicarboxylic acids, or the endogenous substrates is not affected. Synthesis of citric acid by yeast is inhibited by 2:4 DNP. Oxidation of acetate-1-C^{14} and of acetate-2-C^{14} incorporates C^{14} into the yeast in proportion to the acetate oxidized. Distribution of C^{14} in the tagged metabolites and in the carbon dioxide fits the view of a citric acid cycle. The oxidation of exogenous acetate promotes the oxidation of the yeast's endogenous substrates. The 2:4 DNP prevents oxidation of the radioactive acetate and promotes oxidation of the endogenous substrates which are tagged during the oxidation of the former. The 2:4 DNP selectively inhibits the incorporation of radioactive acetate into citric acid and thus inhibits the operation of the citric acid cycle. (auth)

21237

RADIOAUTOGRAPHIC STUDY OF THE METABOLISM OF CONNECTIVE TISSUE. R. E. Mancini (Faculty of Medical Sciences, Buenos Aires). p.147 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

A radioautographic study of the connective tissue of rat skin at different ages, carried out with sulfur-35, methionine-S^{35}, and adenine-C^{14}, showed that embryo and early postnatal tissues have higher S^{35} uptake than the adult. The S^{35} was taken up first by fibroblasts and then by the intercellular material. Mastocytic uptake was more intense than that of the fibroblasts, but the differences in uptake corresponding to age were not so marked as in the fibroblasts. With adenine-C^{14} and methionine-S^{35} the mastocytic and fibroblast uptake was higher than that of the intercullular material, and uptake by the fibroblasts was greater in the embryonic and early postnatal tissues in the adult. Incubation of histologic sections with barium hydroxide, hyaluronidase, and perchloric acid always showed S^{35} incorporated by a sulfurated mucopolysaccharide. Adenine-C^{14} is taken in by the nucleoproteins, and methionine-S^{35} by the proteins. A relationship exists between the metabolic activity of the fibroblasts and the maturing and differentiation of connective tissues from birth to adulthood. (auth)

21238

NEW HORIZONS IN THE ANIMAL SCIENCES. Paul B. Pearson (Ford Foundation, New York). p.149-51 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Applications of radioisotopes and radiation as tools for research in the animal sciences are discussed. (C.H.)

21239

CONTRIBUTION OF RADIOISOTOPES TO STUDY OF MINERAL METABOLISM. C. L. Comar (Cornell Univ., Ithaca, N. Y.). p.153-60 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Applications of radioisotopes in studies of mineral metabolism are reviewed. Emphasis is placed on applications in studies of the metabolism of fission products and physiological and nutritional studies in domestic and laboratory animals. (C.H.)

21240

MILK FORMATION IN INTACT COWS WITH RADIOCARBON AS A METABOLIC TRACER. Max Kleiber (Univ. of California, Davis). p.161-71 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Results are reported from a series of tracer studies on milk formation in cows. Carbon-14 was used as a tracer. (C.H.)

21241

TRACER STUDIES IN THE COFFEE PLANT (COFFEA ARABICA L.). E. Malavolta, L. Neptune Menard, J. D. P. Arzolla, O. J. Crocomo, H. P. Haag, and W. L. Lott (Univ. of São Paulo, Brazil). p.173-8 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Results are reported from studies on problems involved in coffee production. Data are reported from studies on zinc and nitrogen deficiency under field conditions, leaf absorption, and ways to supply phosphatic fertilizers to the coffee plant. (C.H.)

21242

UPTAKE AND TRANSLOCATION OF IRON 59 IN PHASEOLUS VULGARIS L. Leopoldo Villegas (Instituto Venezolano de Investigaciones Científicas, Caracas). p.179-82 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

A study was made of the active uptake of iron at different stages of growth in black bean plants in relation to the rate of live weight increase. Weight increase and absorption values remained constant during vegetative growth and increased with maturation, with flower and fruit development. But the relationship between the two remained constant. This constant relationship suggests also a constant level of accumulation. The irreversibility of the process of active absorption was proved. A study was made of the retranslocation at different stages of growth, with affirmative results, although this process slows down as the plant matures. (auth)

21243

USE OF RADIOISOTOPES AND RADIATION IN PLANT PHYSIOLOGY. Ludwig Müller (Inter-American Inst. of Agricultural Sciences, Turrialba, Costa Rica). p.183-9 of "Radioisotopes and Radiation in the Life Sciences.

2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Applications of radiation and radioisotopes in studies of plant physiology are discussed. (C.H.)

21244

USE OF RADIOACTIVE TRACERS IN SOIL FERTILITY STUDIES. Jose F. Saiz Del Rio (Inter-American Inst. of Agriculture Sciences, Turrialba, Costa Rica). p.191-6 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Uses of radioactive tracers in studies of soil fertility are reviewed. Emphasis is placed on the uptake of fertilizers by plants. (C.H.)

21245

APPLICATIONS OF ATOMIC ENERGY TO AGRICULTURE BY THE NATIONAL ATOMIC ENERGY COMMISSION OF ARGENTINA. Santos Soriano (Comisión Nacional de Energía Atómica, Buenos Aires). p.197-203 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

In the Department of Biology and Medicine of the NAEC of Argentina, the Division of Agricultural Research maintains a seed irradiation service using x rays, neutrons, and gamma rays, which has treated more than 115 kg of selected seeds, sent in from various regions of the country, corresponding to some 50 species of cultivated plants, most of which have economic importance from an agricultural point of view. In the same institution, radioisotopes are now being used to study the problems affecting preservation of the fertility of soil. An experiment was described through which it was possible to verify intensification of assimilation of phosphorus from the soil as a result of adding organic matter. Radiobiology centers were established or are being established in all the schools of agriculture of the national universities, namely, at Buenos Aires, La Plata, Nordeste (Corrientes), Tucumán, and Cuyo (Mendoza), under the tutelage of the NAEC. In the study of microbiological problems, it was possible to obtain, through mutagenic effects of gamma radiations, a mutation of each of two closely related species of bacteria, Azotobacter chroöcoccus and Azotobacter Beijerinckii, which has raised an interesting problem of natural species formation, the systematic implication of which is being subjected to experimental investigation. (auth)

21246

USE OF Fe^{59} IN THE STUDY OF ERYTHROPOIESIS. G. Hodgson (Univ. of Chile, Santiago). p.205-10 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Experiments were described in which Fe^{59} was used to evaluate erythropoiesis. The results show the usefulness of studying the distribution of Fe^{59} at the various sites such as plasma, bone marrow, erythrocytes, and deposit ion in organs at intervals after injection of the tracer. With these data it is possible to estimate the consumption of iron by the marrow and the deposits, and the speed of maturation of the precursor of erythrocytes. To obtain these data it is essential to measure the specific activity of the plasma iron and not merely the radioactivity. The studies with Fe^{59} evaluate the synthesis of hemoglobin and not the number of erythrocytes delivered by the marrow per unit of time. Nevertheless, knowing the relationships between the level of blood iron, the number of precursors of erythrocytes, and the utilization of iron by the marrow, it is possible to infer, from the iron used by the bone marrow at a determined level of blood iron, the number of precursors present in the marrow. From this information and from the average time of maturation, the number of erythrocytes delivered into the circulation may be estimated. The application of Fe^{59} to the evaluation of erythropoiesis has permitted the development of sensitive techniques of quantitative biological assay that in turn have facilitated studies on hematopoietin and indicated to the clinical investigator the possibility of studying the levels of that factor in various pathological conditions. (auth)

21247

ABSORPTION OF RADIOACTIVE VITAMIN B_{12}, TRIOLEIN, AND OLEIC ACID IN TROPICAL SPRUE. A. A. Cintron-Rivera (Univ. of Puerto Rico, San Juan). p.215-16 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

All cases of sprue in relapse studied showed a defect in the absorption of Vitamin B_{12}. Two thirds of the cases of sprue in remission and hematologically well gave values that indicated a marked decrease in the absorption of Vitamin B_{12}. In only 26% of cases with sprue in remission and hematologically well was the absorption of Vitamin B_{12} completely normal. Two of the 45 cases studied showed a correlation in the defect of absorption of Vitamin B_{12} when repeating the Shilling test using the Vitamin B_{12} in combination with intrinsic factor. The absorption of radioactive triolein and oleic acid was used as a differential test in the diagnosis of the steatorrheas and to evaluate fat absorption in cases of tropical sprue before and after treatment. (auth)

21248

ERYTHROCINESIS IN POLYCYTHEMIA VERA. J. E. Varela, M. A. Etcheverry, E. E. Capalbo, and G. Bomchil (Comisión Nacional de Energía Atómica, Buenos Aires). p.217-23 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Results are reported from studies on 218 patients on the pathology and treatment of polycythemia vera. Chromium-51 and iron-59 were used as tracers. Results are included of treatment with phosphorus-32. (C.H.)

21249

BIOSYNTHESIS OF RADIOACTIVE ROTENONE. Luis W. Levy and Ricardo A. Munoz (Escuela Politécnica Nacional, Quito). p.225-8 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Rotenone is an insecticide obtained from the roots of various species of plants, among which is barbasco (Lonchocarpus nicou), a large plant which grows in the Amazonian forests. Radioactive rotenone was prepared by applying acetate containing carbon-14 to the leaves of the barbasco plants in their own environment, harvesting the roots after treatment, and extraction of radioactive rotenone. It was shown that both carbon atoms of acetate are incorporated in rotenone in barbasco plants. (C.H.)

21250

RADIOISOTOPES IN THE STUDY OF THE MECHANISMS OF ACTION OF INSECTICIDES. Robert L. Metcalf (Univ. of California, Riverside). p.237-52 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Sym-

posium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Uses of radioisotopes in studies of the fundamental mode of action of insecticides are discussed. Problems involved in the synthesis of labeled compounds are discussed. (C.H.)

21251

International Atomic Energy Agency, Vienna.
USE OF RADIOISOTOPES AND SUPERVOLTAGE RADIATION IN RADIOTELETHERAPY. Present Status and Recommendations. Report of and Background Information for a Study Group Convened by the IAEA and WHO. 1960. 88p. $1.50.

The Study Group on the Use of Radioisotope Teletherapy Units and Supervoltage Radiation in Radiotherapy jointly convened by the International Atomic Energy Agency and the World Health Organization met in Vienna on August 3 through 5, 1959. Recommendations of the Study Group are presented for the guidance of users of supervoltage radiation or radioisotope teletherapy units. Data are tabulated on the geographical distribution of radioisotope teletherapy and supervoltage radiation units. A list of current research projects is included. Factors affecting the selection of equipment are discussed. The value of supervoltage radiation in the treatment of cancer is compared with other forms of radiotherapy. Requirements as to organization and personnel and facilities for the training of personnel for the use of supervoltage radiation are discussed. Recommendations are included for additional training and information exchange. (C.H.)

Biochemistry, Nutrition, and Toxicology

21252 AEC-tr-4031

TOXICOLOGY PROBLEMS OF RADIOACTIVE MATERIALS. (Voprosy Toksikologii Radioaktivnykh Veshchestv). Translated from a publication of the State Publishing House of Medical Literature, Moscow, 1959. May 1960. 120p. OTS.

A publication concerned with medical aspects of radioactive substances is presented. Included are discussions on general characterization of radioactive substances, body absorption, distribution, and excretion, clinical aspects of radioactive damage, pathological body changes and remote sequelae, and principles of therapy. Also included are discussions on determination methods for radioactive substances in biological media, informative data on various elements, and radioactive elements used in medical practice. 79 references. (J.R.D.)

21253

DISTRIBUTION OF STRONTIUM-89 AND STRONTIUM-90 IN THE ORGANS AND EGGS OF HENS. L. A. Buldakov, D. I. Il'in, and Yu. I. Moskalev. Biophysics (U.S.S.R.) (English Translation) 4, No. 6, 97-102(1959).

During prolonged administration of Sr^{89}–Sr^{90} mixtures through the gastro-intestinal tract the greatest amount of activity is found in the bones and muscles of the hens. This activity constitutes 98.2 to 99.8% of the total activity of the organs. The concentration in the bones is 100 to 500 times greater than in the muscles, liver, kidneys, or pancreas, and 10 to 50 times higher than in the lungs. The eggs contain 5 to 10% of total activity of the organs. The shell concentration is 460 times greater than in the white and 150 times that of the yolk. The effective half-elimination period for the bones is 39 days for Sr^{89} and 144 days for Sr^{90}. (B.O.G.)

21254

EXCRETION ANALYSIS OF INTERNAL CONTAMINATION BY RADIOCERIUM Ce^{144}. V. Slouka (Isotope Lab., Second Medical Dept., Königgrätz, Czech.). Folia Biol. (Prague) 6, 248-56(1960). (In English)

Cerium-144 administered intravenously disappears from the blood very rapidly. Twenty four hours following injection, the liver contains about 54%, bone 25%, kidney 2.1%, and spleen 2.4% of the amount administered. The decrease in all organs is roughly exponential, the only exception being the bones. Excretion analysis makes it possible from the beginning of the 3rd week after contamination onward to obtain values which are in very good agreement with measured retention values. (C.H.)

21255

REPEATED AND TWO SIDE AUTORADIOGRAPHY OF BONE MARROW SMEARS. L. Beneš and V. Drášil (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 6, 257-62(1960). (In English)

Two new autoradiographic techniques described include repeated autoradiography, and two-side autoradiography. The former makes it possible to test the reproducibility of results, and to work with cells labelled with two isotopes of different half-life. In two side autoradiography, the customary preparation of specimens on slides has been abandoned in favor of a new technique consisting in the imbedding of tissue specimens in a thin film of polymethylacrylate and celloidin. Emulsion is applied to this film on both sides, which makes for greater accuracy in the evaluation of the specimen. Applications on bone marrow smears are illustrated. (auth)

21256

RADIOACTIVE IODINE CONCENTRATION IN THE FETAL HUMAN THYROID GLAND FROM FALL-OUT. William H. Beierwaltes, Horace R. Crane, Audrey Wegst, Norma R. Spafford, and Edward A. Carr, Jr. (Univ. of Michigan Medical Center, Ann Arbor). J. Am. Med. Assoc. 173, 1895-1902(1960) Aug.

A study was made of the occurrence of I^{131} in human fetal thyroid glands apparently resulting from I^{131} received by the mother from nuclear weapons testing or other types of population contamination. Radioactivity compatible with I^{131} was found in the human fetal thyroid gland. The maximum concentration of I^{131} was 265 $\mu\mu$c per gram of fetal thyroid tissue, 29.1 $\mu\mu$c per gram of adult hog thyroid tissue and 22.9 $\mu\mu$c per gram of adult thyroid tissue. The highest activity found on a reagent blank was 10.0 $\mu\mu$c. The calculated maximum total radiation delivered to any human fetal thyroid gland was 0.47 rads. The average total dose was 0.05 rads. Extrapolations from data on animals suggest that it is unlikely that this quantity of radiation would produce hypothyroidism or carcinoma of the thyroid gland. (auth)

21257

DETERMINATION OF Sr^{90} IN SAMPLES OF ANIMAL BONES. A. Benco, A. Malvicini, and L. Vido (Comitato Nazionale per le Ricerche Nucleari, Ispra, Italy). Minerva nucleare 4, 125-7(1960) May. (In Italian)

A method for the separation of Sr^{90} from the bones of animals is described. The values for the Sr^{90} contents of cow, sheep, and fowl bones are presented. These findings refer to samples collected during Summer and Autumn, 1959. For each species, individuals of various ages were studied in order to demonstrate possible variations in the Sr^{90} content dependent on dietary factors. The dose of internal radiation due to Sr^{90} in cow's bone was found to be equal to the dose attributable to natural radioactivity. (auth)

21258

OBSERVATIONS ON THE IONIC CONTENT OF VARIOUS TISSUES STUDIED BY RADIOISOTOPES. S. Lamperi and F. Di Pietrantonj (Universita, Genoa). Minerva nucleare 4, 137-41(1960) May. (In Italian)

The time required for the exchange in the tissues of the extracellular sodium with previously administered radiosodium and the quantitative distribution of this ion in the organs of normal or hydrocortisone treated rats were determined. It was found that after the administration of radiosodium a prompt equilibrium tends to occur in the tissues considered (heart, lung, liver, and kidney). A rather uniform behavior was observed in regard to this equilibration in all tissues, although significant differences of the ionic contents were found between the various organs. The greatest amount of sodium was found in the renal medulla and in the lung even after the fraction attributable to the blood contained in these organs was subtracted from their weight. The influence of hydrocortisone on the organic sodium composition in these experimental conditions seems to be due mainly to variations of the dynamic factors which maintain this factor. (auth)

21259

EFFECTS OF RADIOPROTECTIVE COMPOUNDS ON TOXICITY OF NITROGEN MUSTARD. Lorenzo Cima and Franco Pozza (Università, Padua). Ricerca sci. 30, 680-5(1960) May. (In Italian)

The protective action of radioprotective compounds on the toxicity of nitrogen mustard in mice (LD_{99}/6 days) was studied. The maximum protective action was observed by employing diethyldithiocarbamate (Na salt), a drug of the chelating agents group, and it has been progressively weaker with metabolic depressants, polyalcohols, and antioxidizing drugs. No action was observed by employing sulfihydrillic compounds, hormones and amines. On the basis of the knowledge on the action mechanism of alkylating agents there is discussed the mode of the protective activity developed by certain drugs, which are considered as typical radioprotective compounds, pointing out some analogies between action mechanisms of alkylating agents and of ionizing radiations. (auth)

Fallout and Ecology

21260 NP-8862

RADIOACTIVE CONTAMINATION OF MARINE PRODUCTS IN JAPAN. May 1960. 41p.

Separate abstracts have been prepared on the five papers on radioactive contamination of marine organisms collected from 1954 through 1958 from the Pacific Ocean area near Japan. (C.H.)

21261 NP-8862(p.1-2)

Japan. National Hygiene Lab., Tokyo.

RADIO-NUCLIDES FOUND IN LIVERS OF TUNAS FROM THE PACIFIC IN 1958. Kakuma Nagasawa, Yasumasa Kido, and Yoshihiko Kashida.

The livers of tuna and sword fish caught in the Pacific Ocean during 1958 were analyzed for radioactivity. Data are tabulated on total radioactivity and levels of selected fission products and non-fission nuclides. (C.H.)

21262 NP-8862(p.3-8)

Japan. National Inst. of Health, Tokyo.

RADIO-NUCLIDES IN TISSUES AND ORGANS OF THE PACIFIC TUNAS. Toshiharu Kawabata.

Radiochemical analyses were made of contaminated marine organisms collected from the Pacific Ocean between 1954 and 1958. The presence of zirconium-65, iron-55, iron-59, cobalt-57, cobalt-58, cobalt-60, cadmium-113, and other nuclides was confirmed. Data are tabulated. Results are related to nuclear weapons tests in the Bikini region. (C.H.)

21263 NP-8862(p.9-12)

Tokyo Univ. Fisheries Inst.; Japan Analytical Chemistry Research Inst., Tokyo; and Japan. National Inst. of Radiological Sciences, Tokyo.

^{90}Sr IN MARINE ORGANISMS IN JAPAN. Yoshio Hiyama, Makoto Shimizu, Junko Matsubara, Tamiya Asari, Tadashi Ariki, and Ryushi Ichikawa.

Samples of clam shell and fish bones of various species were collected in Japan between 1954 and 1958 and analyzed for radioactivity. The fish species were selected to represent the inhabitants of various strata in the sea, and the extent of their migrations was known to some extent. Data are tabulated on levels of strontium-90, yttrium-90, and calcium. (C.H.)

21264 NP-8862(p.13-17)

Japan. Tokai Regional Fisheries Research Lab.

A RADIOCHEMICAL STUDY OF THE PELAGIC FISH CONTAMINATED BY NUCLEAR TEST. Harumi Tozawa.

Samples of six kinds of fish caught between 1954 and 1958 at five stations in the Pacific Ocean were analyzed for radioactivity. Data are tabulated. The effects of weapons tests on results are discussed. (C.H.)

21265 NP-8862(p.18-38)

Japan. Tokai Regional Fisheries Research Lab.

RADIOACTIVITY OF MARINE ORGANISMS AND SEDIMENTS IN THE TOKYO BAY AND ITS SOUTHERN NEIGHBOURHOOD. Zinziro Nakai, Rinnosuke Fukai, Harumi Tozawa, Shigemasa Hattori, Katsuo Okubo, and Takashi Kidachi.

Measurements were made of the radioactivity of marine organisms, ocean water, and ocean sediment from the sea adjacent to Japan collected between 1957 and 1960. Data are tabulated. (C.H.)

21266 RIGO-1960-5

Netherlands. Rijksverdedigingsorganisatie, TNP. Medisch Biologisch Laboratorium, Rijswijk and Netherlands. Gezondheidsorganisatie, TNO. Radiobiologisch Instituut, Rijswijk.

RADIOACTIVE STRONTIUM IN SOIL, CROPS, FOODSTUFFS AND HUMAN BONES IN THE NETHERLANDS. PART 3. (Radioactief Strontium in Grond, Gewassen Voedingsmiddelen en Menselijk bot in Nederland. Deel 3). J. F. Bleichrodt, T. H. L. van Beukering, G. W. Barendsen, and T. L. J. Beusker. June 1960. 12p. (MBL-1960/13).

Data are tabulated on levels of strontium-90 in samples of soil, grass, and milk collected in June 1959. Data are compared with those of May 1958. (C.H.)

21267 UWFL-59

Washington. Univ., Seattle. Lab. of Radiation Biology.

STRONTIUM-90 AND GROSS BETA ACTIVITY IN THE FAT AND NON-FAT FRACTIONS OF COCONUT CRAB (Birgus latro) LIVER COLLECTED AT RONGELAP ATOLL DURING MARCH 1958. Diptiman Chakravarti and Ronald Eisler. Mar. 1959. 13p. Contract AT(45-1)-540. OTS.

The values for strontium-90 and gross beta activity in the fat and non-fat fractions from the livers of twelve coconut crabs (Birgus latro) collected at Rongelap Atoll during March 1958 are presented. Although fat constituted an average of 47 percent by weight on a wet weight basis (74 percent on a dry weight basis), gross beta activity of the fat fraction amounted to less than 0.5 percent of the total activity on a wet weight basis. Fat content on a wet

weight basis had a range of 31 percent to 65 percent. There is a linear relationship between strontium-90 activity and gross beta activity. Since the fat content of coconut crab liver is variable and the fat fraction contains practically no radioactivity, it is suggested that the radioactivity (and mineral content) of liver samples be compared on the basis of the non-fat solids. (auth)

21268 UWFL-64

Washington. Univ., Seattle. Lab. of Radiation Biology. POTASSIUM AND CESIUM-137 IN BIRGUS LATRO (COCONUT CRAB) MUSCLE COLLECTED AT RONGELAP ATOLL. Diptiman Chakravarti and Edward E. Held. Jan. 15, 1960. 14p. Contract AT(45-1)-540. OTS.

Radiocesium and stable potassium levels were determined in samples of muscle tissue of Birgus latro, the coconut crab, collected at Rongelap Atoll, Marshall Islands, during March and August 1958 and March 1959, and at Utirik Atoll in March 1959. Levels of cesium-137 ranged between 731 d/m/g dry weight at Kabelle Island, Rongelap Atoll, and 28 d/m/g dry weight at Utirik Island, Utirik Atoll. The average potassium value for all samples was 13.05 mg/g dry weight with a standard deviation of 3.66. No significant correlation between cesium-137 and potassium levels was found. There was no significant difference in the average levels of cesium-137 in crabs collected at different times at the same island. (auth)

21269

THE STATE OF CALCIUM AND STRONTIUM IN GOAT'S MILK. A. R. Twardock, W. H. Prinz, and C. L. Comar (Cornell Univ., Ithaca, N. Y.). Arch. Biochem. Biophys. 89, 309-12(1960) Aug.

In a study with goat's milk, 70 to 80% of milk calcium was caseinate bound, whereas about 80% of the remainder was ultrafiltrable. Casein bound strontium to a greater extent than it did calcium, indicating some mechanism other than protein binding is operative in the preferential movement of calcium over strontium from blood to milk. Differences between in vitro and in vivo labeling exist and should be taken into account in studies of ion-exchange techniques for removal of strontium from milk. (auth)

21270

STUDIES ON THE UTILIZATION OF LEVULINIC ACID. II. PROMOTIVE ACTION OF ACID OXIMES ON THE EXCRETION OF RADIOACTIVE CESIUM. Kazuhiko Takamiya (Univ. of Tokyo). Arch. Biochem. Biophys. 89, 325-7(1960) Aug.

The influences of levulinic and α-ketoglutaric acid oximes on the urinary excretion of Cs were studied. Results showed that the urinary excretion was almost exponential and both acid oximes increased the Cs excretion. (M.C.G.)

21271

ACCUMULATION COEFFICIENTS OF SEVEN RADIOISOTOPES BY THREE FRESH WATER ALGAE. E. A. Gileva (Inst. of Biology, Urals Branch of the Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 132, 948-9(1960) June 1. (In Russian)

Limited tests carried out on the uptake of S^{35}, Ca^{45}, Fe^{59}, Co^{60}, Zn^{65}, Rb^{86}, and Zr^{95} by Scenedesmus, Cladophora, and Spirogyra showed a strong accumulation of iron, zinc, and zirconium, a lesser accumulation of rubidium and calcium, and a much weaker accumulation of sulfur and cobalt. Accumulation by single cell Scenedesmus is much weaker than that of the filarial algae. The tests confirmed the feasibility of using algae as a biological purifier of radioactive waters. (R.V.J.)

21272

ACCUMULATION COEFFICIENTS OF RADIOACTIVE ISOTOPES OF 16 DIFFERENT ELEMENTS BY FRESH-WATER ORGANISMS AND THE EFFECT OF COMPLEXON EDTA ON SOME OF THESE COEFFICIENTS. N. V. Timofeev-Resovskii, E. A. Timofeeva-Resovskaia, G. A. Miliutina, and A. B. Getsova (Inst. of Biology, Urals Section of the Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 132, 1191-4(1960) June 11. (In Russian)

Data are presented on the uptake of P, S, Ca, Fe, Co, Zn, Ge, Rb, Sr, Y, Zr, Nb, Ru, I, Cs, and Ce isotopes by duck weeds, pond weed, crowfoot, aquatic plant, bladderwort, water thyme, and other fresh water plants and 17 types of marine organisms (leeches, snails, water bugs, crabs, carp hybrides, and tadpoles of lake frogs). A mean radioisotope uptake coefficient was determined for each individual plant and organism. Except for P and Sr the uptake by plants is higher than in organisms. All elements are separated into high and low uptake coefficient groups: high; P, Fe, Co, Zn, Y, Zr, Nb, and Ce; and low, S, Ge, I, and Cs. The plants show exceptionally high accumulation coefficients for Fe, Zn, Y, Nb, and Ce. Tests of EDTA (ethylenediaminetetraacetate or trilon B) effects on the uptake coefficient show sharp drops for Fe, Co, Zn, Y, and Ce uptake (10 to 100 fold). Somewhat smaller drops in uptake were observed for Ca, Zr, Nb, Ra, and I, while Rb, Sr, and Cs uptake increases. Uptake of the other elements was not affected. (R.V.J.)

21273

STRONTIUM 90 IN MILK IN 1957–1960 AND ITS RELATION TO NUCLEAR FALLOUT. Vilém Santholzer and Jaroslav Nosek (Charles Univ., Prague). Jaderná energie 6, 217-21(1960). (In Czech.)

In single months of 1957, 1958, and 1959, the lowest content of Sr-90 in milk was about one strontium unit. [January 1957, September 1959]. The highest value was measured in December 1958, 12 strontium units. The content of Sr^{90} increased in the autumn of 1957, when several nuclear tests had occurred. This increase was high in the winter of 1958/59 as a result of larger series of nuclear tests in 1958. Since autumn 1959, the activity of the fall-out has fallen rapidly. By February 29th, 1960, it had decreased to about 1% of that measured during the second half of 1959. This fact is due to the temporary stopping of nuclear tests on November 1st, 1958. The influence of the French nuclear test of March, 1960 will be the matter of a future report. (auth)

21274

FALL-OUT CAESIUM IN SURFACE SEA WATER OFF THE CALIFORNIA COAST (1959-60) BY GAMMA-RAY MEASUREMENTS. Theodore R. Folsom, G. J. Mohanrao, and Perrin Winchell (Univ. of California, La Jolla). Nature 187, 480-2(1960) Aug. 6.

A method of determining the amount of Cs^{137} in surface sea water off the California coast by gamma measurements was developed. The Cs^{137} in a barrel of sea water, brought down by the addition of sodium cobaltinitrite, was collected as a precipitate having a volume of about 250 ml. This wet material placed near a 3 in. diameter NaI crystal gave an accurate and reproducible measure of the Cs content. A 256-channel gamma spectrometer and a digital computer accessory for storing information were used in the study. Results of twenty preliminary assays made on 200 liter sea water samples taken just beyond the surf zone are given. (M.C.G.)

21275

PLASMA LEVELS, URINARY EXCRETION, AND INCREASE

IN BODY BURDEN OF STRONTIUM-90 IN MAN. Joseph Samachson (Montefiore Hospital, New York). Radiation Research 13, 192-204(1960) Aug.

Data obtained from the administration of a single dose of Sr^{85} were applied to the case of daily ingestion of Sr^{90}. On the basis of various intake levels of daily Sr^{90} ingestion, the data were used to calculate possible values for excretions, body retentions, and plasma levels of Sr^{90} in human patients. By means of the relations found between Sr^{85} and Ca metabolism, the values of Sr^{90} for most individuals can also be obtained from urinary calcium excretion, without need for Sr^{85} studies. Values for body retention are in line with those found by Sr^{90} analysis of bone samples. A wide range of body retentions can occur in adults even on a single dietary Sr^{90} intake as a result of differences in metabolism of Sr and Ca from one individual to the next. Variations of dietary intake further increase the range of body retentions. Two methods were used for the calculation of Sr^{90} plasma levels. Both indicate that, on a given Sr^{90} intake, plasma levels of Sr^{90} vary relatively little in different individuals or from children to adults. Sr^{90} plasma levels do vary, however, directly with Sr^{90} intake and on an intake of 5 $\mu\mu c$ of Sr^{90} per day are of the order of 0.10 $\mu\mu c$/l plasma. (auth)

21276

ANALYSIS OF RADIOACTIVE CONTAMINANTS IN BIOLOGICAL MATERIALS. Eduardo Penna-Franca (Univ. of Brazil, Rio de Janeiro). p.65-75 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Results are reported from an investigation of strontium-90 in various biological materials collected in Brazil during 1957 and 1958. Data are included on radioactivity in samples of milk, rain water, drinking water, bones, Brazil nuts, almonds, peanuts, and other materials. (C.H.)

Radiation Effects on Living Tissues

21277 A/AC.82/G/L.358(Add.1)

National Academy of Sciences.

A REPORT TO THE PUBLIC ON THE BIOLOGICAL EFFECTS OF ATOMIC RADIATION. Based on 1960 Summary Reports. 1960. 21p.

Abstracts are presented of summary reports covering the findings and recommendations of six committees established to study the biological effects of atomic radiations. Topics covered include the genetic effects of radiation, pathological effects of radiation, the meteorological aspects of world-wide fall-out, radiation in agricultural research and applications in agricultural projects and food processing, the disposal of radioactive wastes, and applications of radiation in oceanography and investigations in fisheries. (See also A/AC.82/6/L.358.) (C. H.)

21278 NRC-5377

National Research Council of Canada. Div. of Applied Physics, Ottawa.

GONADAL EXPOSURE DOSE TO ADULTS IN DIAGNOSTIC RADIOGRAPHY. J. L. Wolfson and C. Garrett. Dec. 1959. 67p. (APXNR-809).

Measurements of gonadal exposure dose to adults in diagnostic radiography were made under a wide variety of conditions, using a phantom. The measurements of both skin and gonadal dose are presented in 46 tables, for both males and females, for nineteen of the views most commonly taken in medical radiography. The tables include data showing the variation of exposure dose with such quantities as target-film distance, filtration, peak kilovoltage, and field size. (auth)

21279 TID-6152

Minnesota. Univ., St. Paul.

THE CAUSE AND NATURE OF AN APLASTIC ANEMIA OF THE BOVINE AND ITS RELATION TO RADIATION PANCYTOPENIA. Progress Report No. 5 [Covering the Period June 16, 1959 to June 15, 1960]. M. O. Schultze and J. H. Sautter. 56p. Contract AT(11-1)-364. OTS.

Aplastic anemia can be induced in calves by feeding toxic specimens of trichloroethylene-extracted soybean oil meal or by intravenous injection of S-(dichlorovinyl)-L-cysteine (DCVC). The hematological effects of the two substances appear to be the same. DCVC is extremely toxic for calves, and less so for rats and chickens. The blood dyscrasia induced by DCVC is similar in many respects to that produced by whole-body gamma irradiation. The mechanism by which DCVC induces fatal aplastic anemia in susceptible species was investigated. Methods are described for the synthesis of DCVC labeled with sulfur-35, tritium, or carbon-14. Progress is reported in studies on the metabolism of labeled DCVC in rats and calves, the effects of DCVC on morphology of E. coli, the effectiveness of imino acids and various aromatic acids in the prevention of toxic effects of DCVC in E. coli, an investigation of the nucleotide composition of bovine blood and its relation to hypoplastic anemia, and the effectiveness of treatment with autologous bone marrow on the survival of calves exposed to a lethal dose of gamma radiation. A list of publications during the period is included. (C.H.)

21280 TID-6159

New England Deaconess Hospital, Boston and Harvard Univ., Boston. Medical School.

THE EFFECTS OF IONIZING RADIATIONS ON THE DEVELOPING ANIMAL WITH SPECIAL REFERENCE TO THE NERVOUS SYSTEM. Progress Report and Application of Renewal of Atomic Energy Commission Contract AT(30-1)-1454. Samuel P. Hicks. June 1960. 68p. OTS.

Findings are summarized from studies on the effects of radiation on the development of the nervous system in mammals. Radiation has been proven to be a useful tool for experimental mammalian embryology in studies of normal brain development as well as in studies of abnormalities of brain development. Manuscripts are included of papers accepted for publication. (C.H.)

21281 TID-6264

Nebraska. Univ., Lincoln.

EFFECTS OF X-RAYS AND THERMAL NEUTRONS ON PLANT METABOLISM. Final Report. Francis A. Haskins. [1960]. 32p. Contract AT(11-1)-393. OTS.

The single-cross maize hybrid, L 289 × 1205, was used in all phases of the research except that part dealing with chromatographic analysis. New seeds of the hybrid Wf9 × Hy were used for the chromatographic work. The following effects of x rays and thermal neutrons in seedlings grown from irradiated maize seeds were observed: mitotic activity was drastically reduced, and cell length was somewhat increased in root tips produced from the irradiated seeds; patterns of fresh weight distributions and of the distribution of acid phosphatase and peroxidase activities in the etiolated shoot were appreciably altered by the treatments; effects on the distribution of polyphenolase activity were less pronounced; and quantitative alterations in the metabolism of amino acids and/or related compounds were produced by the treatments. (W.L.H.)

21282 CEA-tr-X-194

DETÉRMINATION DE L'URANIUM PAR FLUORESCENCE. I. PROJECT D'ÉQUIPEMENT ET ESSAI. (Determination of Uranium by Fluorescence. I. Installation and Experimental Project.) R. Fernández Cellini, F. de la Cruz Castillo, and R. Berrera Pinero. Translated into French from Anales real soc. españ. fís. y quím. (Madrid). Ser. B 55, 277-88(1959).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 14305.

21283 JPRS-5030(p.35-46)

CHANGES IN THE BIOELECTRICAL ACTIVITY OF THE CEREBRAL CORTEX OF RABBITS WITH THE INHALATION OF RADON AND THE APPLICATION OF RADIOACTIVE DRESSINGS. S. N. Ardashnikov and M. L. Rait (Rayt). Translated from Med. Radiol. 5, No. 1, 18-22 (1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8365.

21284 JPRS-5030(p.47-63)

CHANGES IN THE LYMPHATIC CIRCULATION AFTER LOCAL IRRADIATION WITH IONIZING RADIATION IN LARGE DOSES. V. M. Mastryukova. Translated from Med. Radiol. 5, No. 1, 23-8(1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8366.

21285 JPRS-5030(p.100-12)

THE ROLE OF HYALURONIDASE IN MECHANISMS OF EARLY INCREASE IN THE PERMEABILITY OF TISSUE BARRIERS AFTER THE EFFECT OF IONIZING RADIATION. N. I. Arlashchenko. Translated from Med. Radiol. 5, No. 1, 42-6(1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8368.

21286

THE PRODUCTION OF BRONCHIAL CARCINOMAS IN MICE. Olive Gates and Shields Warren (New England Deaconess Hospital, Boston and Harvard Medical School, Boston). Am. J. Pathol. 36, 653-71(1960) June.

Broncho-pulmonary carcinomas were induced in mice by an internal emitter of gamma radiation, cobalt 60. Beads containing Sr^{90} did not cause lung tumors, but did produce one carcinoma of the skin and one carcinoma of the esophagus. However, too few animals lived sufficiently long to give these findings significance. The radiation reactions found were histologically similar to those produced by Co^{60}. The observations indicate that continuous gamma radiation in heavy doses will cause carcinoma of bronchial and atrial cells. The pulmonary neoplasms were less common than cancer of the skin in this series of mice, even though lung tissue received heavier or as heavy doses, compared to the skin. The duration and rates of exposure were comparable. Leukemia was no more frequent than was lung cancer, and its incidence was not related to the dose in linear fashion. (auth)

21287

VISUAL SENSATIONS INDUCED BY X-IRRADIATION OF THE EYE WITH DOSES OF THE ORDER OF ONE MILLIROENTGEN. G. K. Gurtovoi and Ye. O. Burdianskaia (Inst. of Biological Physics, Academy of Sciences, Moscow and Helmholtz State Research Inst. for Diseases of the Eye, Moscow). Biophysics (U.S.S.R.) (English Translation) 4, No. 6, 65-71(1959).

Some indications were previously reported concerning the level of minimum x-ray dose which produces a light sensation. From the investigations described, it is concluded that the near threshold dose is 1 mr. These experiments were conducted with a single irradiation of the eye with doses lasting 0.14 sec at 135 kv using 5 to 8 mm copper filters. The subjects were dark-adapted for 1 hr prior to the tests. (B.O.G.)

21288

THE EFFECT OF IONIZING RADIATION ON BIOELECTRIC POTENTIALS IN PLANT SEEDLINGS. A. M. Kuzin and Yu. I. Karnaukhov (Inst. of Biological Physics, Academy of Sciences, Moscow). Biophysics (U.S.S.R.) (English Translation) 4, No. 6, 71-8(1959).

Potential difference (p.d.) measurements were made on irradiated four-day-old barley seedlings of the "Viner" variety. The results showed a substantial stability immediately after irradiation. The irradiation of barley seedlings by 3000, 10000, and 30000 r does not alter the statistically established deviation of p.d. in irradiated plants from the norm either immediately after irradiation (0.8 hr) or after 25 hr. Two to five days following irradiation a regular decrease of p.d. was observed in the irradiated seedlings. Despite the fact that 3000 and 5000 r completely inhibit further development and growth of the plants, it is evident that doses of 30000 r did not have any important influence on the p.d. (B.O.G.)

21289

EFFECT OF RADIATIONS ON EHRLICH ASCITES CARCINOMA IN CONNEXION WITH THE PROBLEMS OF PROTECTION. II. ACTION OF PROTECTIVE SUBSTANCES ON INCIPIENT RADIATION REACTION OF MAMMALIAN CELLS. Ye. N. Tolkacheva (Inst. of Biological Physics, Academy of Sciences, Moscow). Biophysics (U.S.S.R.) (English Translation) 4, No. 6, 84-9(1959).

An investigation was made to ascertain the protective action of glutathione and sodium pentobarbitone on mitotic activity and chromosome aberrations or irradiation of Ehrlich ascites carcinoma cells. The cells were studied on the sixth day after tumor transplant in white mice. The animals were exposed to 500-r doses of x rays at a rate of 50 to 62 r/min and potentials of 170 to 190 kv. The protective substances were administered intraperitoneally in sub-toxic doses 5 to 10 and 15 to 20 min, respectively, before irradiation. The ascitic fluid was extracted at various times after irradiation, and the changes in the mitotic index were followed for 24 hr. The results from this investigation indicate that the protective action of flutathione and sodium pentobarbitone leads to a decrease in the radiation-induced destructive changes. (B.O.G.)

21290

THE EFFECT OF FRACTIONATED DOSES OF X-IRRADIATION ON THE CAPACITY OF PLANTS TO RESUME GROWTH. I. M. Vasil'ev and B. G. Zhukov (Inst. of Bio-physics, Academy of Sciences, Moscow). Biophysics (U.S.S.R.) (English Translation) 5, 45-7(1960).

The effects of x radiation on the growth of seedlings were greater when the 5 kr dose was administered at one time than when it was administered as a fractionated dose. (C.H.)

21291

EFFECT OF CHRONIC IRRADIATION ON DRIED RYE SEEDS. L. P. Breslavets (Inst. of Biological Physics, Academy of Sciences, Moscow). Biophysics (U.S.S.R.) (English Translation) 5, 48-53(1960).

The action of ionizing radiations in small doses over a lengthy period of time has been investigated. The method of irradiating fruits and seeds of various plants for 27 days

before sowing has shown that with prolonged irradiation the dose of 1000 r for x rays can be cut to one-third with an increased yield of 20 per cent. Prolonged γ-irradiation at a dose of 341 r for 27 days accelerated cell division in the root meristem by 6 per cent as compared with cell division in unirradiated cells. The investigation has confirmed a relationship between the acceleration of cell division and the stimulatory effect. (auth)

21292

THE RADIOSENSITIVITY AND EMBRYOGENESIS OF ASCARIS SUIS OVA. I. D. Vinogradov (Inst. of Biological Physics, Academy of Sciences, Moscow). Biophysics (U.S.S.R.) (English Translation) 5, 54-9(1960).

Periodic variations have been observed in the radiosensitivity of developing ascaris ova, which were obviously connected at early stages of division with the process of mitosis, and at later stages with damage to sectors of tissue and organs of vital importance for the further development of the organism as a whole. (auth)

21293

INCREASE IN THE YIELD OF RADISHES AND CARROTS BY X- OR γ-IRRADIATION OF THE SEEDS BEFORE SOWING. L. P. Breslavets, N. M. Berezina, G. I. Shchibria, M. L. Romanchikova, V. A. Iazykova, and Z. F. Mileshko. Biophysics (U.S.S.R.) (English Translation) 5, 86-7(1960).

Exposure of dry radish seeds to 1000 r radiation resulted in improved growth of seedlings. Field trials over 3 years showed an increased yield of 11 to 33% from irradiated seeds, with crops ripening 5 to 6 days earlier than the controls. Exposure of carrot seeds to doses of 2000 to 4000 r resulted in increased germinating capacity and a 26% increase in yield of carotin content. Irradiation doses which increased the yield of other agricultural plants were established. These included rye, 1000 r; peas, 500 r; cucumbers, 300 r; and tomatoes, 1000 r. (C.H.)

21294

THE APPLICATION OF IONIZING RADIATION IN PLANT SELECTION. V. V. Khvostova and S. A. Valeva (Inst. of Biophysics, Academy of Sciences, Moscow). Biophysics (U.S.S.R.) (English Translation) 5, 87-91(1960).

Applications of ionizing radiation in plant selection are discussed. It is pointed out that cells altered by irradiation result in altered metabolism which may be reflected by alteration or morphological characteristics. These alterations may be inherited and the mutations caused by irradiation result in a certain proportion of useful modifications of practical value for obtaining improved varieties. By means of irradiation it is possible to modify the characteristics of a given variety of plant in a relatively short time and by selection to develop improved plants. The use of ionizing radiation is of special value in the selection of vegetatively reproduced plants. Irradiation of buds produces a large number of modifications and the modified shoots can then be multiplied vegetatively. Irradiation can also be applied to seeds, pollen, buds, tubers, rhizomes, and cuttings. Irradiation methods and results are described. (C.H.)

21295

THE EFFECT OF IRRADIATION ON THE PERMEABILITY OF RADICLES OF VICIA FABA. T. G. Mamedov (Moscow State Univ.). Biophysics (U.S.S.R.) (English Translation) 5, 92-5(1960).

Results are reported from a study of changes in the permeability in bean radicles induced by irradiation. The effects of irradiation on the rate of growth of Vicia faba seedlings was also studied. (C.H.)

21296

NATURE OF PRIMARY CHANGES IN CELL RADIATION DAMAGE. V. N. Korogodin and N. V. Luchnik (Moscow State Univ. and Biophysics Lab. of the Urals Branch, Academy of Sciences, USSR). Biophysics (U.S.S.R.) (English Translation) 5, 96-100(1960).

A working hypothesis is described according to which local damage to cells by ionizing radiations with low linear density of ionization may be of a latent character and the possibility of its appearance dependent on the cumulative action of the dose, the physiological state of the cells, and the conditions of the medium. The hypothesis is used to explain the previously described recovery of diploid yeasts and cells of pea rootlets after irradiation. (auth)

21297

SOME BIOMEDICAL PROBLEMS IN THE NUCLEAR ERA. Charles L. Dunham (U. S. Atomic Energy Commission, Washington, D. C.). Bol. inform. junta control energía atómica (Peru) 5, 107-13(1960) May-June. (In Spanish)

Three categories of biomedical problems arising from the use of radiation and radioisotopes in research, medicine, and industry are discussed. The first category deals with the definition of radiation dose and the relationship of the exposure dose to biological effects. In the second category the relationship between the concentration of a given radioisotope in the environment and the exposure resulting for various organisms of the body is discussed. The development of methods of prophylaxis and effective treatment for the entire organism and for local lesions produced by radiations is considered under the third category. (J.S.R.)

21298

TREATMENT OF CARCINOMA OF THE BLADDER. A SYMPOSIUM. III. PATHOLOGICAL CHANGES IN THE BLADDER FOLLOWING IRRADIATION. N. F. C. Gowing (Royal Marsden Hospital, London). Brit. J. Radiol. 33, 484-7(1960) Aug.

Histological studies were carried out on tissues from 50 cases of proven bladder carcinoma. Thirty-five had received radiotherapy. Gross and microscopic changes induced by radiation are described. (C.H.)

21299

PHARMACOLOGICAL ASPECTS OF THE VASCULAR PERMEABILITY CHANGES IN THE RAT'S INTESTINE FOLLOWING ABDOMINAL RADIATION. D. A. Willoughby (Strangeways Research Lab., Cambridge, Eng.). Brit. J. Radiol. 33, 515-19(1960) Aug.

Irradiation of the abdomen of rats was followed by increased capillary permeability of the intestine to circulating protein-bound trypan blue. These changes are clearly visible 24 hours after x irradiation, and are maximal by 72 to 96 hours. Pre-treatment of the rats with antihistaminics caused a marked suppression of the vascular changes during the first 24 hours, but has no subsequent effect. During the first 24 to 48 hours the ileum was almost completely depleted of histamine and 5 hydroxytryptamine. The increased capillary permeability normally observed from 48 hours onwards could be markedly reduced by prior treatment of the animals with various anti-esterase drugs. It is postulated that following irradiation of the abdomen, the increased capillary permeability of the intestine is mediated initially by histamine and then maintained by an enzyme system involving a protease or esterase. (auth)

21300

THE RADIOSENSITIVITY OF THE EMBRYONIC NERV-

OUS SYSTEM. Roberts Rugh (Columbia Univ., New York) and Erica Grupp. Bull. Sloane Hosp. for Women 5, No. 2, 49-52(1959).

X irradiation to 200 r at 8.5 days of the mouse embryo, at the time of early neurogenesis, will result in exencephalia in many cases but among the apparently normal litter mates it is here demonstrated that the brain and spinal cord of some if not all fetuses living at 18.5 days are so damaged that the mice cannot be regarded as normal by any standard of consideration. In a similar vein it is suggested that lower exposures, particularly at earlier stages of development, may result in neurological deficiencies which are not readily apparent but which may be revealed by more delicate studies now in progress. (auth)

21301

LOCAL INHIBITION BY CYSTEAMINE OF DEPILATION AFTER X IRRADIATION IN YOUNG MICE. D. Radivojevic, M. L. Beaumariage, and Z. M. Bacq (Institut "Boris Kidric," Vinca, Yugoslavia; Université, Liége; and Institut Interuniversitaire des Sciences Nucléaires, Brussels). Compt. rend. soc. biol. 154, 422-4(1960) June. (In French).

The effects of cysteamine on black mice 5 or 8 days old exposed to 550 whole-body x radiation were investigated. It was shown that cysteamine subcutaneously injected inhibits locally the depilation of the mice by x radiation. The protective effects of cysteamine are generalized over the entire pilous system. (J.S.R.)

21302

IRRADIATION BY X RAYS AND AQUEOUS DIURESIS. M. L. Beaumariage and G. Barac (Université, Liége). Compt. rend. soc. biol. 154, 424-8(1960) June. (In French)

The effect of x radiation on the renal functioning in the rat, rabbit, and dog was studied to determine if irradiation can modify significantly the yield of aqueous diuresis. The techniques used in the three cases are described. Results show that x radiation does not cause constant and significant polyuria in the rat, rabbit, or dog. Whereas the rat is characterized by a variable urinary elimination, the rabbit regularly exhibits oliguria. The dog, in acute experiments, shows a rise in diuresis. (J.S.R.)

21303

THE EFFECT OF RIBONUCLEIC ACID FROM YEAST ON THE SURVIVAL ON THE 30TH DAY OF WHOLE-BODY IRRADIATED RATS. NEW INVESTIGATIONS. J. Maisin, P. Dumont, and A. Dunjic (Université, Louvain, Belg.). Compt. rend. soc. biol. 154, 429-32(1960) June. (In French)

It was shown previously (Compt. rend. soc. biol. 153, 379 (1959)) that the ribonucleic acid extracted from yeast increases significantly the survival rate of rats irradiated with x-ray doses which in the control caused death by the medullar syndrome in the majority of individuals. The present study attempts to define the magnitude and the circumstances of this action. The rats were exposed to 500 r, a dose which corresponds to an LD_{85} and which causes death by medullar aplasia. The results show that ribonucleic acid from yeast injected intraperitoneally fifteen minutes after irradiation increases the survival on the 30th day ("dose reduction factor" of 1.12). This effect is attributed to a restoration process at the liver level. (J.S.R.)

21304

EFFECT OF CORTISONE AND ACTH ON THE SUPRARENAL MODIFICATIONS OF THE IRRADIATED HAMSTER. E. H. Betz (Université, Liége). Compt. rend. soc. biol. 154, 468-70(1960) June. (In French)

Hamsters were exposed to whole-body x irradiation of 825 r, and the effects of cortisone and ACTH on the adrenal modifications were determined. The observations show that the adrenal modifications are magnified by ACTH and inhibited by cortisone. These facts suggest a hormone origin for the adrenal modifications and particularly of the vacuolization of the cortex. Adrenal hemorrhages occurred in the irradiated hamsters receiving ACTH. (J.S.R.)

21305

THE EFFECT OF INJECTIONS OF THE ALKALINE HYDROLYZATES OF RIBONUCLEIC ACID FROM YEAST ON THE SURVIVAL ON THE 30TH DAY OF RATS IRRADIATED WITH A DOSE OF 500 r. J. Maisin, P. Dumont, and A. Dunjic (Université, Louvain, Belg.). Compt. rend. soc. biol. 154, 475-9(1960) June. (In French)

The hydrolysis products of ribonucleic acid from yeast injected into the rat after a total dose of 500 r increase considerably the survival of the animals on the 30th day. The hydrolysis can be extended up to the mononucleotide stage. Several biochemical processes capable of taking this effect into consideration are discussed. (tr-auth)

21306

THE EFFECT OF γ-RAYS ON EMBRYONIC ERYTHROPOIESIS. A. V. Bursyan (Sechenov Inst. of Evolution Physiology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 132, 206-9(1960) May 1. (In Russian)

The influence of γ rays on embryonic erythropoiesis was studied in the eggs of white leghorn chickens irradiated by Co^{60} γ rays to doses of 1000 to 1300 r at 1.2 to 1.45 r/min after 5 to 8 days of incubation. The cells per mm^2 of blood and relative and absolute numbers of cells of megalo- and normoblastic series indicate that megaloblast erythropoiesis begins in certain small blood areas of the extraembryonic mesenchyme following one day of incubation. This is followed by bleeding in the capillaries of the yoke-bag wall. The data show that the megaloblastic reaction after 5 days of incubation is less expressed than after 8 days. The number of megaloblastic erythropoiesis cells in peripheral blood was determined by the intensity of cell production and destruction. Embryonic blood megalocytes suffer strong structural changes after 5 days of exposure (nuclear fragmentation, irregular amitosis, pathological mitosis, etc.). The cariolysis and picnose destroy some of the cells and the number of megocytes is reduced. Later the destruction processes slow down and megaloblastic erythopoiesis continues. A return to the original ontogenetic bleeding after 8 days of exposure and arrested megaloblastic erythropoiesis were observed in a second set of tests. (R.V.J.)

21307

THE EFFECT OF TOTAL X-RAY IRRADIATION ON THE ACTIVITY OF ACID AND ALKALINE PHOSPHATASE OF BRAIN, LIVER, AND SPLEEN IN RATS. L. F. Pomazanskaya (Pavlov Inst. of Physiology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 132, 1197-1200(1960) June 11. (In Russian)

Effects of whole-body irradiation on the acid and alkali activity of the phosphatase of brain, liver, and spleen in rats were studied immediately after and at intervals following exposure to 500 and 2000 r. Parallel studies of tissue activity and correlation of the radiation effects were analyzed. (R.V.J.)

21308

AN INVESTIGATION OF THE EFFECTS OF N-PHENYLBENZAMIDINE, N-PHENYL-2-FURAMIDINE AND N-PHENYLAMIDINE OF THIOPHENE-2-CARBOXYLIC

ACID ON THE RESISTANCE OF SUSPENSIONS OF B. ANTHRACIS, B. CEREUS, CAND. ALBICANS AND STAPHYLOCOCCUS AUREUS TO GAMMA RAYS FROM Co^{60}. S. Robev and S. Todorov (Medical School for Graduate Work and Specialization, Sofia). Doklady Akad. Nauk S.S.S.R. 132, 1201-3(1960) June 11. (In Russian)

The radiation resistance of bacterial suspensions and the effects of amidine solutions on radiation resistance were investigated. Radiation effects were determined by counting the number of surviving cells and their ability to colonize. B. anthracis, B. cereus, Cand. albicans, and Staph. aureus-209 were used in the studies. The B anthracis and B. cereus showed high resistance to radiation to 300 r; neither of the microŏrganisms vary their radiosensitivity in the presence of amidine compounds. The suspension of Cand. albicans (at a γ dose of 50 kr) showed good radioresistance. The data indicate that the best radioprotection achieved with amidine solutions was from 1:500 to 1:2500; with stronger solutions the survival drops and at 1:4000 there was no protection. In Staphylococcus aureus, amidines exhibited radioprotective properties in the form of a sensitizer. The radioinduced damage with α TA begins with solution of 1:3000 and disappears at about 1:30,000. It is postulated that radiosensitization properties of αFA in Staph. aureus are the result of its spatial relation to the furan ring and to its grouping. (R.V.J.)

21309

THE NATURE OF RADIATION DAMAGE IN A T_4 PHAGE INACTIVATED BY γ-RADIATION. G. E. Fradkin and Yu. P. Vinetskii. Doklady Akad. Nauk S.S.S.R. 132, 1204-5(1960) June 11. (In Russian)

Gamma radiation effects on the structural morphology of phage were studied in a T_4 phage suspension in synthetic Adams medium with particle titre 10^{10} per ml, exposed to 25, 50, and 100 thousand r (from Co^{60} at 400 r/min). Tests indicated that irradiated viruses become inactivated, losing their reproductive ability. The most rapid inactivation process takes place at phage irradiation with 100,000 r; it was observed that three days following exposure to this dosage 99.98 to 99.99% are inactivated. Correlations of the data indicate that radioinduced bacterial inactivation is not followed by morphological disintegration of phage corpuscular structure. Consequently, the damage affects only certain high polymer virus components at the molecular level. (R.V.J.)

21310

CHROMOSOMAL DISTRIBUTION OF MUTATOR- AND RADIATION-INDUCED MUTATIONS IN D. MELANOGASTER. P. T. Ives (Amherst Coll., Mass.). Evolution 13, 526-31(1959) Dec.

Three series of x chromosome lethal mutations, from the mutator hi, from 300 r and from 12.5 kr of cobalt-60 γ radiation, all showing normal crossing over with y ct^6 ras^2 f, were analyzed for distribution of lethal loci, chiefly with respect to the four regions set off by the marker genes. The distributions are compared to each other and to proportions of available genetic material in each region. The radiation series show similar distributions and are also similar to the proportionate distribution of bands. The mutator series differs strongly from the others, with an especially high concentration of lethals in the ct-ras region and different relative proportions of lethals in the other regions. There is an apparent and moderate concentration of lethal loci near f^+ in each of the three series. This may reflect either a group of genes with exceptional mutagenic properties or the occurrence of chromosome aberrations between f and the kinetechore which do not reduce crossing over sufficiently in the ras-f region to be detected by the methods used here. The difference between mutator and radiation lethal loci distribution is consistent with the hypothesis that mutator genes are genetically more specific, ionizing radiations more general, in their mutagenic effects. It is suggested that series of spontaneous lethals from strains of D. melanogaster derived recently from different geographic areas may be expected sometimes to show different chromosomal distributions but that series of lethals induced in such strains by a given radiation treatment should be generally alike. (auth)

21311

EFFECT OF IONIZING RADIATION ON DEOXYRIBONUCLEIC ACIDS. II. THE MOLAR RELATIONSHIP OF DEOXYRIBONUCLEIC ACID BASES OF RAT SPLEEN AFTER THE ADMINISTRATION OF PYRIMIDINE DEOXYRIBOTIDES. E. Paleček and J. Soška (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 6, 168-71(1960). (In English)

Desoxycytidylic acid or thymidylic acid was administered intraperitoneally to rats one day after they had been irradiated with a total-body dose of 400 r. On the fifth day after irradiation the animals were killed and the ratio of the bases was determined in DNA isolated from the spleen. In rats to which desoxycytidylic acid was administered, the guanine/cytosine quotient and the adenine/thymine quotient were lower than in the irradiated controls. After the administration of thymidylic acid only the guanine/cytosine quotient was reduced. In no group, however, did all base relationships return to normal values. (auth)

21312

COMPARISON OF THE EFFECT OF SOME NUCLEOTIDES AND NUCLEOSIDES ON THE MITOTIC INDEX IN THE BONE MARROW OF IRRADIATED MICE. J. Soška and Z. Karpfel (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 6, 172-8(1960). (In English)

Results are reported from a study of the effect of different nucleotides and nucleosides on the bone marrow of mice irradiated with a dose of 500 to 600 r. The effect of riboside and desoxyriboside and of nucleotide and nucleoside derivatives of adenine, guanine, uracil, and thymine was compared. The mitotic index, which was lowered by radiation, was significantly raised on about the sixth day after irradiation following the administration of desoxycytidylic, thymidylic, and desoxyadenylic acid. A less marked effect was observed after thymidine, desoxyadenosine, and cytidylic acid. Desoxyguanylic acid lowered the mitotic index. The other test substances had no effect. (auth)

21313

STUDY OF REGENERATION PROCESSES IN THE BONE MARROW OF IRRADIATED MICE FOLLOWING THE ADMINISTRATION OF PYRIMIDINE DEOXYRIBONUCLEOTIDES. Z. Karpfel, J. Soška, and Nina F. Barakina (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno and Inst. of Animal Morphology, Academy of Sciences, Moscow). Folia Biol. (Prague) 6, 179-85(1960). (In English)

Desoxycytidylic or thymidylic acid was administered to mice irradiated with a dose of 500 to 600 r. After administration of these desoxynucleotides an increase in mitotic activity was observed in the bone marrow, together with stimulation of regeneration. The least mature cell forms

in the bone marrow reacted most promptly to the administration of thymidylic acid by proliferation. After the administration of the desoxyribonucleotide, rather more chromosomal aberrations were found than in the irradiated control. Irradiation significantly lowered the prophase to metaphase ratio. This ratio returned to normal 4 to 10 days after irradiation, recovery being significantly more rapid after the administration of the desoxynucleotide than in the irradiated control. (auth)

21314

DECOMPOSITION OF DEOXYRIBONUCLEOTIDES BY SPLEEN EXTRACTS FROM IRRADIATED MICE. Ludmila Drášilová and V. Drášil (Medical Faculty of the Univ. and Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 6, 186-92(1960). (In English)

Phosphatase activity was studied in mouse spleen extracts up to 52 hours after total-body irradiation. The results show that the non-specific substrate was decomposed to the same degree by normal and irradiated tissue. The greatest changes in desoxyribonucleotides were observed in the decomposition of desoxyadenylic and desoxycytidylic acid. Post-irradiation changes in the dephosphorylation of desoxyguanylic acid were smaller. Phosphatase activity calculated for 10 mg fresh tissue rose most rapidly during the first four hours after irradiation. During subsequent hours the decrease was slower. It appears from the results that the enzyme released by irradiation decomposes nucleotides to a greater degree than the non-specific substrate. (auth)

21315

EARLY POST-IRRADIATION CHANGES IN SLEEP RESPIRATORY METABOLISM IN RATS. A. Vacek (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 6, 193-6(1960). (In English)

The author studied O_2 consumption, CO_2 output, and the RQ during the period immediately following irradiation with doses of 1,000 r and 200 r. Oxygen consumption in rats irradiated with a dose of 1,000 r decreased during the first minute after irradiation. The RQ of this group was statistically significantly lower than in the controls and than in rats irradiated with a dose of 200 r. The mechanism of the changes is discussed. (auth)

21316

PROSPECTIVE POTENTIALITIES OF LYMPHOID TISSUE TO INDUCE HAEMATOPOIETIC RECOVERY IN IRRADIATED MICE PROTECTED BY HYPOXIA. M. Hill and M. Prasličká (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno and Comenius Univ., Kosice, Czech.). Folia Biol. (Prague) 6, 197-207(1960). (In English)

A qualitative and quantitative evaluation of the protective effect of hypoxia on the spleen of mice irradiated with a dose of 650 r and 750 r was carried out. In protected animals destruction of the spleen lymphatic nodules was significantly less than in unprotected mice. Within four days after irradiation, new light centers were formed, while in unprotected mice the nodules underwent further regression. In protected mice a statistically significantly higher level of lymphocytes was maintained in the peripheral blood for 24 hours to four days after irradiation. The granulocyte level was the same as in unprotected animals. Differentiation of reticular cells into blast cells was accompanied in protected animals by smaller degenerative changes in the nucleus and by greater capacity for further maturation in the granulocyte series. In protected animals dedifferentiation of blasts into reticular syncytium took place to a smaller degree. The findings are discussed in agreement with the assumption that regeneration of the hematopoietic tissue of protected animals depends on smaller damage to the lymphocytes, nucleic acid fragments from which are utilized in the differentiation of reticular cells into blasts. (auth)

21317

PROGNOSTIC SIGNIFICANCE OF THE HAEMATOCRIT VALUE IN X-IRRADIATED RABBITS. M. Pospíšil (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 6, 208-11(1960). (In English)

It was found that the hematocrit value (the percentual volume of the red blood cells) before whole-body x irradiation can be used to predict probable mortality among rabbits irradiated with 800 r (LD_{50}). The death rate up to the 30th day among rabbits with high hematocrit values was significantly lower than among animals with low values. This prognostic significance of the hematocrit value is determined by absolute variations in the plasma volume. The relationship between the plasma volume and leukocyte values before and after irradiation indicates the possibility of influencing radiosensitive hematopoietic tissue by water shifts in the organism. (auth)

21318

AN ATTEMPT TO INFLUENCE POSTIRRADIATION LIVER CHANGES. M. Skalka (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 6, 212-18(1960). (In English)

It was found in irradiated mice that the administration of thyroxine or exposure of the organism to oxygen deficiency aggravates liver changes which occur during the second week after irradiation. Under the given experimental conditions thiourea had only a weakly beneficial effect. The results are discussed with reference to the working hypothesis that one of the main factors in liver damage during the second week after irradiation is hypoxia of the liver tissue. (auth)

21319

X-RAY INDUCED CHROMOSOMAL ABERRATIONS IN HORDEUM. Takumi Tsuchiya (Kihara Inst. for Biological Research, Yokohama, Japan). Idengaku Zasshi 35, 58-65 (1960) Feb. (In English)

Chromosomal aberrations are described which were induced by exposure of dormant seeds of Hordeum spontaneum to doses of about 13,500 r x radiation. Cytological effects are summarized for 78 plants in X_2 generation which were raised from semi-fertile X_1 plants. (C.H.)

21320

THE DEVELOPMENT OF THE MAMMALIAN NERVOUS SYSTEM. I. MALFORMATIONS OF THE BRAIN, ESPECIALLY THE CEREBRAL CORTEX, INDUCED IN RATS BY RADIATION. II. SOME MECHANISMS OF THE MALFORMATIONS OF THE CORTEX. Samuel P. Hicks, Constance J. D'Amato, and Mary Jane Lowe (New England Deaconess Hospital, Boston and Harvard Medical School, Boston). J. Comp. Neurol. 113, 435-69(1959) Dec.

Radiation can be used to induce a series of developmental malformations in the brains of rats. The degree of reproducibility of the patterns has suggested their use in studies relating certain attributes of behavior with cerebral cortical structure. The patterns of brain malformation induced by giving 150 to 200 r on each of the days of gestation, 12 to 20, are described and illustrated. Some of the histogenetic mechanisms that lead up to the cortical malformations are described, based on a study of different members of the same abnormal litter taken at successive stages of development. (auth)

21321

IONIZING RADIATIONS. THEIR POSSIBLE RELATION TO THE ETIOLOGY OF SOME CONGENITAL ANOMALIES AND HUMAN DISORDERS. Roberts Rugh (Columbia Univ., New York). Military Med. 124, 401-16(1959) June.

Extrapolations of data from mouse directly to man cannot be made, but results on the rodent can be suggestive of ultimate findings with the human. X irradiations of the testes, the ovaries, the embryo, or the newborn at any stage may have serious consequences that may not be fully realized for generations. Genetic sequelae are not immediately evident in most cases, but embryonic or fetal x irradiation results in immediate deficiencies, particularly in the central nervous system. Since the range of human normality is so great, both with respect to malignancy and intelligence, small decrements following low level irradiation would be difficult to determine. However, the general linearity of effect suggests that x irradiating the embryo, particularly in the early stages, will result in deficiencies among survivors. In later stages there is a two-fold hazard when the fetus develops its own germ cells, the precursors of its entire hereditary line. (auth)

21322

LOCALIZATION BY AUTORADIOGRAPHY AT −195°C. OF RADIOACTIVE AREAS IN RATS EXPOSED TO A HIGH FLUX OF THERMAL NEUTRONS: IMPORTANCE OF PHOSPHORUS-32 IN CONSECUTIVE INTERNAL IRRADIATION. Jean Chanteur and Pierre Pellerin (Institut National d'Hygiene, Chatillon-sous-Bagneux, France). Nature 187, 472-5(1960) Aug. 6.

Work was carried out to localize, by autoradiography at −195°C, the organs of areas of the body of a rat capable of becoming the seat of radioactivity induced by exposure to a high flux of thermal neutrons. Rats weighing 25 g were placed alive, in pairs, in plastic irradiation cartridges and exposed to 5 min irradiation. After ascertaining that they had been killed by the flux of neutrons, the rats were immediately frozen in liquid nitrogen. Autoradiographs were made at times of 1, 2, 12, and 24 hrs, 5, 10, 20, and 30 days. It appeared that an exposure to a flux of thermal neutrons involved, by the radioactivity induced in the body, a general irradiation of relatively short duration by gamma rays of Na^{24} and K^{42} and to much longer irradiation essentially localized in the skeleton by the beta rays of P^{32} and Ca^{45}. The bone marrow, therefore, must be considered as a critical organ with regard to irradiation by thermal neutrons. (M.C.G.)

21323

EFFECTS OF WHOLE-BODY IRRADIATION ON THE BREEDING PLUMAGE OF THE WEAVER-FINCH, QUELEA QUELEA. B. Lofts (Univ. of London), A. J. Marshall, and J. Rotblat. Nature 187, 615-16(1960) Aug. 13.

Seasonally dimorphic weaver finches (Quelea quelea) in full breeding plumage were irradiated with 15-Mev x radiation in doses of 50, 200, 400, 800, and 1,000 r. Six groups of six males and six females each were used, five being irradiated and one being retained as a control. The facial feathers were plucked and then allowed to grow for 4 days before irradiation. For the male, the regenerated feathers were black and identical with those of the male controls up to the 1,000-r dose, in which case the feathers were unpigmented except at the tips which had been laid down in the 4 days before irradiation. For the female, the regenerated feathers were white in the female controls, but the 50-, 200-, and 400-r doses gave feathers with a black band of melanin deposition. The tips, developed before irradiation, were light. However, the 800- and 1,000-r doses gave no melanin deposition, and the feathers remained light. Another experiment was conducted on Quelea in the eclipse condition; doses of 100 and 800 r did not change the face mask feather regeneration to the eclipse condition. (D.L.C.)

21324

THE EFFECT OF SPLENECTOMY ON RADIATION INJURIES IN MICE. H.-J. Melching and O. Messerschmidt (Universität, Freiburg i. B.). Naturwissenschaften 47, 307(1960). (In German)

The effect of a splenectomy carried out before whole-body irradiation on the survival rate of mice was investigated. On the fourteenth day after splenectomy white female mice weighing about 20 g were exposed to 690 x radiation. 67.1% of the splenectomized mice survived after thirty days and only 17.1% of the controls. (J.S.R.)

21325

TUMOURS DEVELOPING IN RATS AFTER INTRAPERITONEAL INJECTION OF PLUTONIUM NITRATE (Pu^{239}). Z. M. Bukhtoyarova and V. K. Lemberg (Academy of Medical Sciences, USSR). Problems of Oncol. (U.S.S.R.) (English Translation) 5, No. 8, 13-24(1959).

Development of osteogenic sarcomas represents the most important late consequence of accumulation of Pu^{239} in the body. The frequency with which osteogenic sarcomas develop depends within a certain range on the size of the dose employed. Osteogenic sarcomas which develop after administration of Pu^{239} are characterized by multicentric growth and by polymorphous structure. In rats of the experimental group soft tissue tumors show a greater variety and are less differentiated than in the control animals. The greatest number of animals with tumors was found after administration of a dose of 1.89×10^{-3}. (auth)

21326

THE INFLUENCE OF RADIOACTIVE COLLOIDAL GOLD UPON THE MITOTIC ACTIVITY OF TUMOUR CELLS. S. M. Volodarskaya (Volodarskaia) (Moscow Medical School). Problems of Oncol. (U.S.S.R.)(English Translation) 5, No. 9, 125-7(1959).

Radioactive colloidal gold administered by intraperitoneal injection to mice with Ehrlich ascites tumor leads to a considerable increase in the mitotic activity of the tumorous cells. (auth)

21327

THE BLASTOMOGENIC ACTION OF THE MIXTURE OF ISOTOPES $Sr^{89} + Sr^{90}$ ON RABBITS. V. N. Strel'tsova and Yu. (Iu.) Moskalev (Academy of Medical Science, USSR). Problems of Oncol. (U.S.S.R.)(English Translation) 5, No. 10, 1-11(1959).

Following injection of $Sr^{89} + Sr^{90}$ malignant tumors developed in rabbits, in the skeleton and in the bone marrow, and in the organs immediately in contact with the radiation. There was also a marked formation of tumors in the endocrine organs not exposed to the immediate action of ionizing radiation. With the entrance into the body of the optimum blastomogenic amount of the mixture of $Sr^{89} + Sr^{90}$, osteosarcomata and leucoses developed in rats and in rabbits with the same dose, with the same frequency, and in the same period. For example, with parenteral injection in rats of the mixture $Sr^{89} + Sr^{90}$ of 0.8 to 1.0 $\mu c/g$ osteosarcomata developed in 11 out of 14 rats and in 10 out of 15 rabbits which lived for 200 days. The vast majority of osteosarcomata in rabbits, the same as in rats, develops in the interval from the 200th to the 400th day. (auth)

21328

THE EFFECT OF X-IRRADIATION ON DIPHOSPHOTHIAMINE. C. Gregolin, C. S. Rossi, and N. Siliprandi

(Univ. of Padua). Radiation Research 13, 185-91(1960) Aug.

Irradiation of aqueous solution of diphosphothiamine with x rays produced the following modifications: a decrease of optical density at 270 mμ; slight dephosphorylation of diphosphothiamine with formation of monophosphothiamine and thiamine; oxidation to diphosphothiochrome and thiochrome; and transformation in oxythiamine with a considerable decrease of the coenzymatic activity on pyruvate decarboxylation. The latter was partly due to diphosphothiamine destruction and partly to the formation of inhibitory compounds, such as diphosphoöxythiamine and oxythiamine. (auth)

21329

EFFECT OF X-IRRADIATION ON CELLULAR INCLUSIONS IN CHICKEN EMBRYO LIVERS. Ole A. Schjeide, Nancy Ragan, Ruth G. McCandless, and F. C. Bishop (Univ. of California, Los Angeles). Radiation Research 13, 205-13(1960) Aug.

Volumes of mitochondria, microsomes, and nuclei were measured by differential centrifugation in liver cells of irradiated 13-, 18-, and 21-day-old chicken embryos and 4-day-old chicks. Counts were made of liver cell mitochondria in 13-, 18-, and 21-day-old embryos. When an exposure of 465 rads of x irradiation was administered 3 days prior to sacrifice, liver cell mitochondria were decreased in numbers in 13- and 18-day-old embryos. These decreases, however, were not observed immediately or within 24 hours after irradiation, suggesting that the mitochondria per se are relatively radioresistant but that their multiplication or maintenance during the rapid division of the liver cells is somehow interfered with. The decreases were correlated with a surfeit of triglyceride in the plasmas of irradiated embryos of these stages. (auth)

21330

IRRADIATION OF PROTEINS IN THE SOLID STATE. II. CHEMICAL CHANGES PRODUCED IN BOVINE SERUM ALBUMIN. Peter Alexander and L. D. G. Hamilton (Roya Cancer Hospital, London). Radiation Research 13, 214-33(1960) Aug.

Changes in nine amino acid residues, which make up 73.5% of bovine serum albumin, have been followed after irradiation of this protein in the solid state with 2-Mev electrons in vacuo. The sensitivity to radiation varies by a factor of 2.5. Although carbonyl groups are formed, no evidence of the breaking of the main chain could be detected. Other products measured included —SH groups, a new amino acid, α-amino-n-butyric acid, and an amide-like group which gives rise to ammonia on hydrolysis. There are pronounced changes in the reactivity of the side chains. The hidden —SH group is revealed, and the position of the tyrosine absorption maximum is shifted, though its abnormally high pK remains unaffected. Some of the amino groups become screened so that they no longer react with 1-fluoro-2,4-dinitrobenzene except in 4 M guanidine hydrochloride. It is concluded that the changes in the amino acid residues cannot explain the denaturation as shown by changes in the reactivity of the side chains and by the physicochemical changes described in an earlier paper. This investigation supports the hypothesis that denaturation is the result of the simultaneous rupture of a number of hydrogen bonds, and that the subsequent chemical changes measured here are not responsible. (auth)

21331

FACTORS FROM SEED EXTRACTS THAT MODIFY RADIOSENSITIVITY. H. J. M. Bowen and J. Thick (Wantage Radiation Lab., Grove, Berks, Eng.). Radiation Research 13, 234-41(1960) Aug.

Seeds of higher plants vary widely in sensitivity to gamma radiation. Thus germination of pine seeds has an LD_{50} of 3.5 to 4.5 krad, whereas in mustard seeds the LD_{50} is about 950 krad. Soaking pine seeds in extracts of mustard seeds increased their LD_{50} to 14 krad, whereas soaking mustard seeds in extracts of pine seeds reduced their LD_{50} to 660 krad. The extracts were fractionated, and protective effects were obtained after treatment with both acidic and basic fractions from mustard seeds. Phenolic and neutral fractions contained germination inhibitors. The sensitizing action of pine seed extract was shown to reside in the acidic fraction, and similar sensitization was caused by pure linoleic and linolenic acids known to be present in this fraction. Pure oleic acid had no effect. The increased sensitivity is believed to be caused by peroxides of the unsaturated fatty acids produced by the radiation. (auth)

21332

STUDIES ON RADIATION-INDUCED MAMMARY GLAND NEOPLASIA IN THE RAT. IV. THE RESPONSE OF FEMALES TO A SINGLE DOSE OF SUBLETHAL TOTAL-BODY GAMMA RADIATION AS STUDIED UNTIL THE FIRST APPEARANCE OF BREAST NEOPLASIA OR DEATH OF THE ANIMALS. C. J. Shellabarger, V. P. Bond, and E. P. Cronkite (Brookhaven National Lab., Upton, N. Y.). Radiation Research 13, 242-9(1960) Aug.

Female Sprague-Dawley rats, 40 days old, exposed to either 400 r or 200 r of total-body Co^{60} γ-irradiation and compared to nonexposed littermate controls were studied under various conditions. During the first 15 months post-exposure breast tumors were removed and the rats were returned to the experiment; after this period the rats were killed as breast tumors were noted, or they were studied until death. Findings are summarized. (C.H.)

21333

CYSTEINE PROTECTION AGAINST X-RAYS AND THE FACTOR OF OXYGEN TENSION. Henry I. Kohn and Shirley E. Gunter (Univ. of California, School of Medicine, San Francisco). Radiation Research 13, 250-5(1960) Aug.

Protection experiments were carried out with washed suspensions of Escherichia coli B/r that were suspended in buffer, exposed to 0.1 M l-cysteine at 22 to 24°C, and then irradiated with 250-kv x rays at 0°C. Trials were made with suspensions in equilibrium with 0, 5, 20, and 100% oxygen at the time of irradiation, at pH 5 and at pH 7.8. l-Cysteine afforded significant protection under all conditions. The mode of action of cysteine therefore includes one reaction that can occur independently of oxygen. The independence is both biologic and radiologic; i.e., oxygen is not needed for cysteine to reach the sensitive locus prior to irradiation, nor is it needed at the time of irradiation. It was also shown in tests at pH 7.4 to 7.8 that the ethyl ester of l-cysteine and d-cysteine protect under anoxic conditions; d-cysteine, however, was significantly less potent than l-cysteine at pH 5. (auth)

21334

THE EFFECT OF 2-AMINOETHYLISOTHIOURONIUM · Br · HBr (AET) ON THYROID ACTIVITY IN NONIRRADIATED AND X-IRRADIATED RATS. P. V. Vittorio and M. J. Allen (Defence Research Lab., Kingston, Ont.). Radiation Research 13, 256-62(1960) Aug.

In the control groups of rats, whole-body x irradiation increased I^{131} uptake by the thyroids and by the protein-bound iodine. In AET-injected groups, whole-body x ir-

radiation decreased I^{131} uptake by the thyroids and by the protein-bound iodine and increased serum I^{131}. In both nonirradiated and x irradiated rats AET (200 mg/kg of rat body weight) decreased I^{131} uptake by the thyroids and by protein-bound iodine but increased the serum I^{131} value. This indicates that the increased serum I^{131} value is not due to an increased PBI^{131} value but probably to the inorganic I^{131} which is being picked up by the blood and is not entering the thyroids. If the lowered iodine uptake by the thyroids and by the serum proteins results in a lowered basal metabolic rate, this could help complement other radioprotective actions by AET. (auth)

21335

INDIRECT EFFECT OF X-IRRADIATION ON SPLEEN ACID DEOXYRIBONUCLEASE ACTIVITY. N. B. Kurnick, Barbara W. Massey, and Andrew Montano (Veterans Administration Hospital, Long Beach, Calif. and Univ. of California, Los Angeles). Radiation Research 13, 263-70 (1960) Aug.

Irradiation of the mouse spleen alone with doses up to to 4000 r causes similar depression of cellular content and much less increase in DNase activity per average cell than 800 r administered to the body with the spleen shielded. Irradiation of body and spleen with 800 r, which is lethal, produces a greater effect on these parameters than irradiation of the body alone with this dose (not lethal). The nature of the indirect effect on the spleen is discussed. (auth)

21336

PROTECTION AGAINST IRRADIATION AFFORDED BY SODIUM FLUOROACETATE. Z. M. Bacq, S. Liébecq-Hutter, and C. Liébecq (Université, Liége). Radiation Research 13, 286-97(1960) Aug.

Sodium fluoroacetate injected into mice at a dose of 4 to 5 mg/kg, 5 hours before irradiation, reduced the mortality produced by 650 to 675 r of whole-body x irradiation. The high levels of citric acid in the tissues of the poisoned animals returned to normal within 24 hours if 675 r of x rays were given 5 hours after 5 mg/kg of sodium fluoroacetate, whereas 48 hours was required in the case of nonirradiated control mice. Thus, x rays interfered with the metabolism of citric acid in the tissues of the mouse as in the tissues of the rat. The liver of the mouse, however, did not behave like the liver of the rat. In contrast to rats, male mice injected with sodium fluoroacetate accumulated citrate in their livers, whereas females did not; whole-body irradiation reduced the level of accumulated citrate in the liver as it did in other tissues of the mouse. The injection of sodium fluoroacetate produced a prolonged hypothermia. It is suggested that the flouroacetate-induced accumulation of citrate protects the animals by complexing magnesium ions necessary for DNase activity. (auth)

21337

MEDIAN LETHAL DOSE FOR GUINEA PIGS OF COBALT-60 GAMMA IRRADIATION. William T. Newton and Michel Ter-Pogossian (Washington Univ. School of Medcine, St. Louis). Radiation Research 13, 298-304(1960) Aug.

The acute 30-day median lethal dose in Hartley guinea pigs was determined for cobalt-60 γ-irradiation. The median lethal dose was found to be 326 rads. Change in weight of the irradiated animals was recorded for a period of 30 days. Extravasation of blood into viscera and serous cavities was the most frequent finding at autopsy. (auth)

21338

EFFICIENCY OF INACTIVATION OF DRY T-1 BACTERIOPHAGE BY PROTONS, DEUTERONS, AND HELIUM IONS FROM A 60-INCH CYCLOTRON. Donald J. Fluke and Frederick Forro, Jr. (Brookhaven National Lab., Upton, N. Y.). Radiation Research 13, 305-17(1960) Aug.

Dry preparations of T-1 bacteriophage were irradiated with protons, deuterons, and helium ions from a 60-inch cyclotron. Phage assay techniques were adapted for high accuracy in determination of survival ratios and for physical characterization of the ion beams employed. Ions yielding LET values differing by factors of up to 15 have all shown about the same effect per unit dose for phage plaque survival. A comparison of 40-Mev helium ions and 1.8-Mev protons at the same LET has shown no significant difference in effect on the phage. Dry T-1 bacteriophage irradiated in a vacuum requires much higher doses for inactivation than does the phage in protected suspension. Auxiliary work with γ rays indicates that the degree of dryness of the phage may be involved in the difference in sensitivity. (auth)

21339

STUDIES ON RADIATION-INDUCED MAMMARY GLAND NEOPLASIA IN THE RAT. V. INDUCTION BY LOCALIZED IRRADIATION. V. P. Bond, C. J. Shellabarger, E. P. Cronkite, and T. M. Fliedner (Brookhaven National Lab., Upton, N. Y.). Radiation Research 13, 318-28(1960) Aug.

Previous studies from this laboratory had demonstrated that a single large whole-body x-ray exposure of Sprague-Dawley rats was followed in months by a large increase in the incidence of mammary gland neoplasia. In addition, the dose-effect relationship appeared to be linear within limits, and intact ovarian function was demonstrated to be necessary for maximum incidence of neoplasia. In the present experiments, designed to determine if the breast tissue must be directly irradiated for maximal neoplasia induction, groups of approximately 30 female Sprague-Dawley rats were irradiated on the fifty-fifth day of age as follows: 400 r total-body irradiation; 400 r entire left half of body; 400 r to chest; 400 r to lower half of body; 400 r with one hind limb shielded; and 400 r through a grid. With half-body exposure and with exposure through the grid, approximately one-half of the total number of neoplasms seen after total-body irradiation was observed. Shielding of the leg had no effect on the incidence of neoplasia. With half-body irradiation, more than 90% of all breast neoplasms occurred in tissues exposed directly to the beam. The results indicate clearly that direct radiation injury to the breast is necessary for an increased incidence of radiation-induced neoplasia under the conditions employed. It appears from these and previous studies that radiation-induced "primary" damage in the target organ is necessary for an increased incidence of the neoplasia observed, but that the primary damage may lie dormant and not manifest itself maximally as neoplasia unless an additional secondary mechanism (presumably cyclic ovarian activity in the data presented) is operative. The implications of the results with regard to a possible somatic mutation mechanism of radiation neoplasia induction are discussed. (auth)

21340

IRRADIATION OF LYMPHOCYTES IN FRESHLY DRAWN BLOOD. Benedict Cassen and Willi Gutfreund (Univ. of California, Los Angeles). Radiation Research 13, 329-34 (1960) Aug.

A technique developed for separating lymphocytes from freshly drawn whole blood was found to work well on rabbit's blood obtained by cardiac puncture. The separated lymphocytes showed typical ameboid motions as much as 8 hours later when observed under a phase microscope.

Samples of blood irradiated in vitro and receiving a dose of 1000 r showed after 6 hours the same viability as the controls. In each sample 25 lymphocytes were observed, almost all showing ameboid motions. Cell counts showed that lymphocytes were not lost by rapid lysis or by being phagocytized during irradiation. On the assumption of the validity of experiments partially simulating in vivo factors, these observations are offered against hypotheses that explain the rapid decrease of lymphocyte count after total-body irradiation on the basis of a rapid lethal effect of the radiation on mature lymphocytes. It is not ruled out that they may be sublethally affected. If the lymphocytes are long-lived cells, as appears probable from the results of several investigators, it would appear that new hypotheses are required to explain the mechanism of their rapid disappearance from the circulation after total-body irradiation. (auth)

21341

COMPARATIVE X-RAY SENSITIVITIES OF RELATED RESPIRING AND FERMENTING YEASTS. Thomas H. Wood (Univ. of Pennsylvania, Philadelphia). Radiation Research 13, 335-42(1960) Aug.

Respiring and derived fermenting haploid yeasts have approximately the same radiation response as measured by cell survival under a variety of modifying agents including anoxia, phase-state change from liquid to solid, and various respiratory inhibitors. The similarity of the oxygen effect in the two strains is evidence that this effect is not primarily mediated through enzymatic respiratory mechanisms. Small differences in the radiation response in the two strains are probably not due to differences in the amount or organization of the cellular water but could be due to metabolic effects such as different growth rates. (auth)

21342

PHYSIOLOGICAL VIGOR AS A FACTOR IN RADIATION REDUCTION OF LIFETIME FERTILITY OF MICE. Loren H. Haverland and John W. Gowen (Iowa State Univ. of Science and Tech., Ames). Radiation Research 13, 356-68(1960) Aug.

Littermate pairs of mice of five inbred strains and all their possible F_1 hybrids were given equal doses of 100-kvp x rays at 2.5 ma at 6 weeks of age. After x-ray exposure, the pairs were mated for life. The x-ray doses were 0, 20, 200, 400, and 800 r. Each of the 125 combinations of doses and inbred and F_1 hybrid strains was represented by at least two matings. The lifetime fertility of matings was drastically reduced when the pairs were exposed to acute x-ray doses of 200 r or more. Pairs exposed to 800 r produced one litter at most. But one-fourth of the matings exposed to 200 r produced two litters. The effects of radiation on lifetime fertility were quite severe in comparison with the effects on some other vital functions investigated. Findings are summarized. (C.H.)

21343

THE EFFECT OF X-IRRADIATION ON SODIUM AND WATER TRANSPORT IN RAT ILEUM. Peter F. Curran, Edward W. Webster, and Jeannette A. Hovsepian (Harvard Univ., Boston and Massachusetts General Hospital, Boston). Radiation Research 13, 369-80(1960) Aug.

X-ray doses of 2500 to 3000 rads were administered to the abdomen of rats, and sodium and water transport by the ileum were studied in vivo at postirradiation times ranging from 6 to 67 hours. Sodium and water were rapidly absorbed from the lumen in control nonirradiated animals. Six hours after irradiation net absorption was considerably reduced, and in the period from 13 to 48 hours there was no net transfer of either sodium or water across the mucosa. Thirteen hours after irradiation normal active transport of sodium from lumen to plasma was stopped. Unidirectional sodium fluxes were lower than those in control animals at all post-irradiation times up to 67 hours. At 67 hours, a significant net movement of both sodium and water into the lumen was observed. The relationship of these observations to the mechanism of intestinal death has been discussed. The observation that active transport was completely inhibited within 13 hours after irradiation cannot be explained by death of epithelial cells and suggests that there was a direct effect of radiation on the active transport process. (auth)

21344

EFFECTS OF IONIZING RADIATION ON NUCLEIC ACID. Eberhard Harbers (Universität, Gottingen, Ger.). Strahlentherapie 112, 333-68(1960) July. (In German)

A survey of present knowledge about function and metabolism of desoxyribonucleic acid (DNA) and ribonucleic acid (RNA) is presented. The nucleic acids have a central position, because they contain the "information" of the cell. Radiation effects on nucleic acids and conceptions about the mode of action of ionizing radiation are discussed. (auth)

21345

STUDIES ON THE EFFECTS OF THE RADIOPROTECTIVE SUBSTANCE β-AMINOETHYLISOTHIURONIUM CHLORIDE HYDROCHLORIDE ON THE RADIOSENSITIVITY OF YOSHIDA SARCOMA OF THE RAT. Erwin Haas and Werner Lorenz (Universität, Mainz). Strahlentherapie 112, 451-6(1960) July. (In German)

Double tumors of Yoshida sarcoma of rats were irradiated with 4 × 400 r, 10 × 200 r, 5 × 200 r, or 10 × 100 r (contact irradiation). Part of the animals had no other treatment, part of the animals received intravenous or intraperitoneal injections of β-aminoethylisothiuronium chloride. In contrast to the healthy tissue the sensitivity to radiation of the tumors was not changed. (auth)

21346

ELECTRON RESONANCE STUDY OF THE REACTION OF A RADIOPROTECTIVE SUBSTANCE WITH FREE RADICALS. Ellinor Schröder, Hans-Günther Thom, Claude Nicolau, and Rudolf Huber (Forschungsgemeinschaft der Deutschen Ademie der Wissenschaften, Berlin). Strahlentherapie 112, 457-61(1960) July. (In German)

The relation between the biologic effect of several substances for radiation protection and their property to capture radicals was studied in model experiments by means of electron resonance measurement. (auth)

21347

INACTIVATION OF BACTERIA BY MEANS OF A SINGLE ELECTRON PULSE. D. L. Dewey and J. W. Boag (Mount Vernon Hospital, Northwood, Middx, Eng.). Z. Naturforsch. 15b, 372-4(1960) June. (In German)

Experiments on the inactivation of the bacterium Serratia Marcescens by radiation have shown that the normal "oxygen effect" is absent when a large dose is given in a single pulse of duration 2 μsec. This appears to be due to the complete removal of the dissolved oxygen by the early part of the pulse dose, as a result of radiation-induced chemical reactions. (auth)

21348

THE ACUTE IRRADIATION SYNDROME AND LATE HEMATOLOGIC EFFECTS. E. P. Cronkite and V. P. Bond (Brookhaven National Lab., Upton, N. Y.). p.501-16 of

"Proceedings of the VIIth International Congress of the International Society of Hematology, Rome, September 7-13, 1958." Rome, Il Pensiero Scientifico, [1958]. (In English)

The acute radiation syndrome differs from ordinary types of injury since there may be a continuum in symptomatology after higher doses, or a latent period at lower doses during which hidden histologic changes are taking place from the time of exposure until recrudescence of symptoms and potential death of the individual. The actual recovery from the initial symptoms does not signify complete biological recovery. Radiation injury consists of both a reparable and irreparable component. The irreparable component persists until eventual death months to years later, and takes many manifestations. The late manifestations of irradiation injury and certain hematologic aspects of the long term problem are discussed. 57 references. (C.H.)

21349

NATURE OF SOMATIC MUTATIONS INDUCED BY RADIATION IN FLOWERING PLANTS. Robin L. Cuany (Brookhaven National Lab., Upton, N. Y.). p.29-37 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Experiments are described in which radiation was used to induce somatic mutations in flowering plants. The contributions of radiation genetics and plant morphogenesis in the improvement of crops which are vegetatively reproduced are discussed. (C.H.)

21350

EFFECT OF RADIATION ON PUFFS OF POLYGENIC CHROMOSOMES OF RHYNCHOSCIARA ANGELAE. C. Pavan (Univ. of São Paulo, Brazil). p.47-52 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Tritiated thymidine was used as a tracer in studies on the effect of radiation on nucleic acid synthesis in chromosomes of Rhynchosciara angelae, a subtropical fly. Photomicrographs are included of radioautograms which demonstrate the incorporation of the tritiated thymidine. (C.H.)

21351

CELL RESTORATION AFTER IONIZING AND NON-IONIZING RADIATION. Luiz Renato Caldas (Univ. of Brazil, Rio de Janeiro). p.53-64 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Reaction mechanisms involved in the induction and restoration of radiation injuries in unicellular organisms are discussed. It is shown that in some cases the sequence of reactions that leads to a radioinduced lesion can be interrupted. (C.H.)

21352

ANTIGENS IN HOMOTRANSPLANTATION OF EMBRYONIC TISSUES IN LETHALLY IRRADIATED MICE. Gustavo Hoecker (Univ. of Chile, Santiago). p.211-13 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Results are reported from studies on mice, rats, and rabbits, of the formation of antigens following the homotransplantation of embryonic tissues in lethally irradiated animals. (C.H.)

21353

USE OF SEXUALLY STERILE MALES FOR ERADICATION OF SCREW-WORMS. Arthur W. Lindquist (U. S. Dept. of Agriculture, Washington, D. C.). p.229-35 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Experimental work to explore the possibility of the use of sexually sterile males for control of the screw worm (callitroga hominivorax) is reviewed. The life history of the screw worm is reviewed and its importance as a parasite of warm-blooded animals is discussed. The destructiveness of the screw worm to livestock is emphasized. Results are reported from experiments in which males were exposed to radiation doses of 2500 to 7500 r before release into the native population. Motile sperms of low viability are produced which impregnate eggs, which die soon after penetration by the irradiated, damaged sperm. Since screw-worm females mate only once a reduction in population is soon evident. Results are reported for an immense eradication program which covered about 50,000 square miles in Florida. (C.H.)

Radiation Sickness

21354 CEA-tr-A-625

PROBLÊMES POSÉS PAR LA MALADIE DUE AUX RAYONNEMENTS À HIROSHIMA, NAGASAKI ET BIKINI APRÈS L'ESSAI DE LA BOMBE H. (Problems Posed by Radiation Sickness at Hiroshima, Nagasaki, and Bikini after H-bomb Experiments.) H. Keim. Translated into French from Atomkernenergie 4, 313-22(1959). 38p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 18816.

21355 JPRS-5030(p.64-81)

THE BLOOD PICTURE AND BONE MARROW HEMATOPOIESIS IN GUINEA PIGS IN THE ACUTE FORMS OF RADIATION SICKNESS CAUSED BY IRRADIATION ON A 25 MeV BETATRON. Ye. D. Gol'dberg. Translated from Med. Radiol. 5, No. 1, 28-35(1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8367.

21356 JPRS-5030(82-99)

PATHOMORPHOLOGICAL CHANGES IN THE GASTROINTESTINAL TRACT IN CHRONIC RADIATION SICKNESS. V. B. Zairat'yants (Zayrat'yants). Translated from Med. Radiol. 5, No. 1, 35-42(1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8386.

21357

A TRIAL OF CYSTAMINE IN RADIATION SICKNESS. J. B. Healy (St. Luke's Hospital, Dublin). Brit. J. Radiol. 33, 512-14(1960) Aug.

A trial was made of the radioprotective substance, cystamine, in radiation sickness. It did not prove more effective than lactose. (auth)

21358

FLUORESCENCE MICROSCOPY AS A DIAGNOSTIC METHOD IN RADIATION SICKNESS. Z. Karpfel and Pavla Žáčková (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 6, 263-6(1960). (In English)

The authors studied early changes in the bone marrow of rats irradiated with a single dose of 25 to 3,000 r and with fractionated doses divided into part doses of 25 r by means

of fluorescence microscopy. The importance of fluorescence microscopy for the early diagnosis of radiation sickness was confirmed. (auth)

21359

GAMMA EMISSION IN ACCELERATED C^{12} ION REACTION WITH Sn NUCLEI. V. A. Kornaukhov and Yu. Ts. Oganesyan. Zhur. Eksptl'. i Teoret. Fiz. 38, 1339-40 (1960) Apr. (In Russian)

The energy spectra of γ rays produced in Sn irradiation by C^{12} ions accelerated up to ~78 Mev were studied using a 150 cm cyclotron external beam with an intensity of $\sim 5 \times 10^{6}$ particle/sec. The tin targets, 24 mg/cm^3, were placed at 45° to the beam. The 0.4 to 4 Mev γ rays were recorded with a scintillation γ spectrometer with a CsI crystal (3 cm in diameter and 3 cm high). The maximum excitation energy of the compound nucleus was ~66 Mev. Correlations of spectra show that the relative number of pulses corresponding to γ quanta with E = 1.5 to 4 Mev increases with reduced distance between the target and crystals. It is postulated that such a phenomenon must be the result of simultaneous recording of weak γ cascades imitating γ rays of large energies. The mean number of simultaneously recorded γ quanta is found to be ~1.8. In order to determine the number of γ quanta in a cascade, data on angular distributions must be available in addition to spectrometer data. However, data on angular distributions from composite nuclei with high angular moment are not yet available; thus an accurate determination of this magnitude is impossible. A rough evaluation indicates that it is not less than 10. (R.V.J.)

CHEMISTRY

General and Miscellaneous

21360 DP-474

Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.

NUCLEAR MAGNETIC RESONANCE SPECTRA OF TRIALKYL PHOSPHATES AND RELATED COMPOUNDS. I. PROTON MAGNETIC RESONANCE SPECTRA. Woodfin E. Shuler and Robert C. Axtmann. June 1960. 63p. Contract AT(07-2)-1. OTS.

High resolution proton magnetic resonance spectra are presented for 48 trialkyl phosphates and related phosphorus compounds. Chemical shifts, spin-spin coupling constants, and spectral analyses are reported for compounds of interest in solvent extraction technology. (auth)

21361 HW-65632

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

WATER CHEMISTRY FOR KER LOOP 1—JUNE 29, 1959 TO DECEMBER 31, 1959. Thomas F. Demmitt and E. R. Wood. June 15, 1960. 10p. Contract AT(45-1)-1350. OTS.

A summary of the water quality data obtained during operation of the loop for the period June 29 to Dec. 31, 1959, is presented. The analytical data obtained indicate that the loop has approximated the proposed NPR quality conditions. (J.R.D.)

21362 NAA-SR-Memo-5125

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

A METHOD OF CORRECTING MASS PATTERNS OF DEUTERATED HYDROCARBONS FOR ISOTOPIC IMPURITIES OF CARBON-13, HYDROGEN AND DEUTERIUM. R. H. Shudde. April 7, 1960. 12p. Contract [AT-11-1-GEN-8]. OTS.

21363 NAFI-TP-99

Naval Avionics Facility, Indianapolis.

TEMPERATURE CONVERSION TABLES. Wayne A. Brodhecker. Nov. 1959. 85p. (PB-161354). OTS.

Tables are presented for converting degrees F to degrees C to 0.001°. The range of the tables is −99.9 to 299.9°F. (C.J.G.)

21364 NP-8893

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

REMARKS ON THE BEHAVIOR OF DIPHENYLCARBAZONE AS ANALYTICAL REAGENT. Report No. 137/VIII. J. Minczewski and W. Żmijewska. Mar. 1960. 11p.

The fading of the color of alcoholic solutions of diphenylcarbazone in organic and mineral acid media was determined as a function of time. (C.J.G.)

21365 NP-8930

Midwest Research Inst., Kansas City, Mo.

THERMALLY STABLE SILICON-CONTAINING RESINS FOR DIELECTRIC APPLICATIONS. Quarterly Progress Report No. 2 [for] March 1—May 31, 1960. L. W. Breed and William J. Haggerty, Jr. June 13, 1960. 26p. M.R.I. Project No. 2373-C. Contract AF33(616)-6916.

Attempts were made to incorporate p-phenylenebis(diethoxymethylsilane) and similar monomers into silicon-containing polymers by several methods. Simple hydrolysis procedures gave intractable materials with about the expected silicon content. The fluoro derivatives of several of these monomers, p-phenylenebis(difluoromethylsilane), p-phenylenebis(difluorophenylsilane), bis-p-(difluoromethylsilyl)phenyl ether, α,p-bis(difluoromethylsilyl)toluene, and 1,6-hexamethylenebis(difluoromethylsilane) were prepared and characterized. Reactions of these compounds with aqueous sodium hydroxide and sodium salts of silanols are described. The incorporation of titanium groups into silicon-containing polymers has been investigated in studies of the thermal stability of titanium monomers and the preparation of a prototype compound with the Si-O-Ti-O-Si group. For chelated titanium alkoxides prepared from acetylacetone, the decomposition products correspond to the product that would be expected from the alcoholysis of acetylacetone. The more stable 8-quinolinol derivative underwent very little decomposition at 200°. The prototype compound of the proposed polymer backbone, bis(8-quinolinol)bis(dimethylphenylsiloxy)titanium, was prepared in good yields either from the corresponding silicon acetate and titanium alkoxide at 150—180° or from the titanium chloride and the sodium silanolate in ether. (For preceding period see NP-8650.) (J.R.D.)

21366 NP-tr-468

THE SOLUBILITY OF SOME OF THE CUPFERRONATES. I. V. Pyatnitskii. Translated by E. Towndrow (U.K.A.E.A. Atomic Energy Research Establishment) from Zhur. Anal. Khim. 1, 57-63(1946). 18p. JCL or LC.

The solubilities of Cu, Fe, Al, Bi, and Sn cupferronates were determined in an acid media. The effects of excess precipitant on completeness of precipitation and solution acidity on solubility of the cupferronates were investigated. (C.J.G.)

21367

ORGANIC COMPOUNDS OF ZIRCONIUM. VII. STUDIES IN ZIRCONIUM SALICYLATES. R. N. Kapoor and R. C. Mehrotra (Gorakhpur Univ., India). J. Am. Chem. Soc. 82, 3495-8(1960) July 20.

The reaction between zirconyl chloride and potassium salicylate was studied by precipitation and titration (conductometric and electrometric) techniques. Further, the reactions of salicylic acid with zirconium tetrachloride and isopropoxide were studied in anhydrous benzene medium. New zirconium compounds isolated were: $Zr(OPr\text{-}iso)_2(OOC \cdot C_6H_4 \cdot O)$, $Zr(OOC \cdot C_6H_4O)_2 \cdot Pr\text{-}isoOH$, $Zr(OOC \cdot C_6H_4 \cdot O)_2$, and $(OOC \cdot C_6H_4 \cdot O)\ Zr(OOC \cdot C_6H_4 \cdot OH)_2$. (auth)

21368

A CALORIMETRIC DETERMINATION OF THE VALUES OF ΔH^0 FOR MERCURY(II)-HALIDE COMPLEX ION REACTIONS AND THE DERIVED VALUES OF ΔS^0. Patrick K. Gallagher and Edward L. King (Univ. of Wisconsin, Madison). J. Am. Chem. Soc. 82, 3510-14(1960) July 20.

The values of ΔH^0 for the reactions $HgCl_n^{+2-n} + Cl^- = HgCl_n^{+2-n}$ (n = 1 to 4) and $Hg^{+2} + 4X^- = HgX_4$ ($X^- = Br^-$ and I^-) in solutions of ionic strength = 0.5 M determined by calorimetric measurements are −5.9, −6.9, −2.2, +0.1, −27.7, and −44.3 kcal., respectively. Coupled with the equilibrium quotient values obtained by Sillen and coworkers, and by Marcus, this study permits the evaluation of the entropy changes accompanying these reactions. The abnormally positive value of the entropy change in the fourth stepwise mercury(II)-chloride reaction suggests that a decrease in coordination number of mercury(II) occurs in this reaction. With some of the data obtained here in combination with data on mercury(II)-bromide reactions reported by Scaife and Tyrrell, the validity of the Latimer and Jolly method of calculating the "replacement" contribution to value of ΔS^0 was demonstrated. (auth)

21369

THE REACTIONS OF RECOIL TRITIUM WITH GASEOUS HYDROCARBONS. J. K. Lee, Burdon Musgrave, and F. S. Rowland (Univ. of Kansas, Lawrence). J. Am. Chem. Soc. 82, 3545-52(1960) July 20.

Recoil tritium reactions with trans-butene-2, cis-butene-2, isobutylene, propylene, and propane were investigated under a variety of experimental conditions. The yields of certain "hot" products, e.g., propylene from butene-2, depended upon the gas pressure during irradiation, because of the variation in mean time before collisional deactivation of excited sec-butyl radicals produced in the original "hot" reactions. The high kinetic energy of recoil tritium atoms enabled them to react almost equally well with saturated and unsaturated positions, both in intermolecular and intramolecular competition, by making differences in activation energy for reaction of minor importance. A general hypothesis for recoil tritium reactions at saturated and unsaturated carbon atoms is presented. (auth)

21370

PARAMAGNETIC-RESONANCE STUDY OF HYPERFINE INTERACTIONS IN SINGLE CRYSTALS CONTAINING α,α-DIPHENYL-β-PICRYLHYDRAZYL. Robert W. Holmberg, (Oak Ridge National Lab., Tenn.), Ralph Livingston, and William T. Smith, Jr. J. Chem. Phys. 33, 541-6(1960) Aug.

α,α-Diphenyl-β-picrylhydrazyl, with and without N^{15}, contained in single crystals of the corresponding hydrazine was studied by the paramagnetic-resonance method. All resolved hyperfine effects arise from the two hydrazyl nitrogen atoms. The tensors describing the hyperfine interaction for each nitrogen and the principal-axes directions were deduced. The tensors were interpreted on the basis of an s-p model with the following electron densities: for the α nitrogen $\alpha_s^2 = 0.011$ and $\alpha_p^2 = 0.263$ with the two parts having the same sign of spin density; for the β nitrogen $\alpha_s^2 = 0.024$ and $\alpha_p^2 = 0.396$ or $\alpha_s^2 = 0.010$ and $\alpha_p^2 = 0.605$. The two choices for the β nitrogen arise from an ambiguity in interpreting the hyperfine tensor, but with either choice the two parts have the same sign of spin density. (auth)

21371

NOTE ON THE INTERNAL ROTATION PROBLEM. William L. Clinton (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 33, 632-3(1960) Aug.

Some comments are made on the internal rotation problem for polyatomic molecules. For two internuclear configurations whose energy gradients are zero, the energy difference between the two or barrier energy is $\Delta W = \frac{1}{2}(\Delta V_{ee} + \Delta V_{en} + \Delta V_{nn})$, where the subscripts refer to electron-electron, electron-nucleus, and nucleus-nucleus interactions, respectively. ΔW is shown to be equal to $\frac{1}{2}\Delta V_{nn}$ for a number of organic compounds, and hence $\Delta V_{ee} = -\Delta V_{en}$. The relation between ΔW and the electronic kinetic energy is discussed with reference to monosubstituted ethanes, and it is concluded that electrostatic models with nonoverlapping charge distributions are not suitable for calculation of barriers to internal rotation. (D.L.C.)

21372

SOLUTE-SOLVENT INTERACTION IN THE SYSTEM HYDROCHLORIC ACID–WATER–TRI-n-BUTYL PHOSPHATE. A. S. Kertes (Hebrew Univ., Jerusalem). J. Inorg & Nuclear Chem. 14, 104-13(1960) July. (In English)

Attempts were made to identify the species formed in a heterogeneous equilibrium between aqueous hydrochloric acid and pure tributyl phosphate. In addition to the conventional distribution and water content determination, measurements of density, viscosity, and conductivity of the organic layer were carried out. Two well defined species were found to exist as a result of solute-solvent interactions in the system studied. The first, formed at lower initial aqueous acid concentrations has the composition $[(TBP)_2 \cdot HCl \cdot (H_2O)_6]$; the second, formed at higher acid concentrations, has the general formula $[TBP \cdot HCl \cdot (H_2O)_3]$. The reactions involved are suggested. (auth)

21373

THE REACTION BETWEEN THENOYLTRIFLUOROACETONE AND ITS URANYL COMPLEX IN BENZENE. Sigfred Peterson (Oak Ridge National Lab., Tenn.). J. Inorg. & Nuclear Chem. 14, 126-7(1960) July. (In English)

King's hypothesis of a soluble addition compound being formed between the uranyl chelate of thenoyltrifluoroacetone (TTA) and TTA in benzene solutions, $UO_2X_2 + HX \rightarrow UO_2X_2 \cdot HX$ (1) where HX = TTA, is confirmed using his data on the solubility of the chelate in benzene solutions of TTA. The plot of chelate solubility vs. TTA concentration gives a straight line at small TTA concentrations; the slope gives a formation constant of ~3.2 for reaction (1) and the intercept gives a chelate solubility of 0.0096 M in pure benzene. At higher TTA concentrations >1.3 M, the plot curves upward. (D.L.C.)

21374

ELECTROLYTE UPTAKE BY ION-EXCHANGE RESINS. David H. Freeman (Massachusetts Inst. of Tech., Cambridge). J. Phys. Chem. 64, 1048-51(1960) Aug.

The measurement of electrolyte uptake by ion-exchange resins is shown to be subject to consistent experimental error and to imperfections within ion-exchange resins. A treatment is presented for handling the imperfections ana-

lytically so as to remove their effect upon the measured electrolyte distribution. The logarithm of the invading species activity coefficient, defined to exclude these imperfections, is thus found to vary linearly with co-ion concentration over a wide range. It is shown that this result is required by a simplified theoretical treatment of invading ion interactions. (auth)

21375

ELECTRON SPIN RESONANCE SPECTRA OF POLYMETHYL METHACRYLATE AND POLYETHYL METHACRYLATE. I. S. Ungar, W. B. Gager, and R. I. Leininger (Battelle Memorial Inst., Columbus, Ohio). J. Polymer Sci. 44, 295-302(1960) June.

A difference was shown to exist in the electron spin resonance spectra of commercial-grade and laboratory-purified samples of polymethyl methacrylate and polyethyl methacrylate. This difference arises because of the presence of monomer. The spectra of the pure polymers show only partial resolution, while the spectra of samples containing monomer have the nine-line pattern as previously reported. (auth)

21376

THE CONCENTRATION DEPENDENCE OF THE SELF-DIFFUSION COEFFICIENTS OF STRONTIUM ION IN AQUEOUS POLYSTYRENESULFONIC ACID SOLUTIONS. E. P. Hardy, Jr. and J. Steigman (Polytechnic Inst. of Brooklyn). J. Polymer Sci. 44, 475-82(1960) June.

The diffusion coefficients of strontium in 10^{-4}M aqueous solutions of polystyrenesulfonic acid were measured at 26°C. The coefficients were low, about 0.15×10^{-5} cm^2/sec, until strontium equivalent to one-fifth of the sulfonates was added. They then increased relatively rapidly, to about 0.7×10^{-5} cm^2/sec, as the concentration of strontium was increased to 10^{-4}M. These results were interpreted to mean either that the binding of counterions to a polyelectrolyte is limited to parts of a chain and is not related to the chain as a whole, or else that there is a recurring regularity of structure in the atactic polystyrene sulfonic acid which limits binding of counterions to a fraction of the total charged sites. (auth)

21377

TRITIUM-LABELED COMPOUNDS. IV. D-GLUCOSE-6-t, D-XYLOSE-5-t, AND D-MANNITOL-1-t. Horace S. Isbell, Harriet L. Frush, and Joseph D. Moyer. J. Research Natl. Bur. Standards 64A, 359-62(1960) July-Aug.

Methods are presented for the preparation of D-glucose-6-t, D-xylose-5-t, and D-mannitol-1-t by the reduction of suitable compounds with lithium borohydride-t in anhydrous tetrahydrofuran, followed by hydrolysis of the products. The starting materials for the reductions are, respectively, 1,2-O-isopropylidene-D-glucurono-6,3-lactone, 5-aldo-1,2-O-isopropylidene-D-xylo-pentofuranose, and 2,3:5,6-di-O-isopropylidene-D-mannofuranose. The apparatus and procedure for carrying out the reductions in a closed system are described. (auth)

21378

ABSORPTION SPECTRUM OF THE COMPLEX FORMED BY URANIUM(VI) WITH MORIN. Zoltán Sámsoni. Magyar Tudományos Akad. Atommag Kutató Intézete (Debrecen), Közlemenyek 2, 53-5(1960). (In Hungarian)

The absorption spectrum of the complex formed by uranium(VI) with morin was investigated with a spectrophotometer. In the range of 300 to 720 mμ, two absorption maxima were found at 360 and 495 mμ. For the purpose of practical measurements the latter maximum is suitable. At 495 mμ, the molar extinction coefficient of the complex of uranium(VI) with morin was found at 12500 ± 200. (auth)

21379

SPECTROPHOTOMETRIC STUDIES OF PLUTONYL NITRATE COMPLEXES IN ACETONE. V. M. Vdovenko, A. A. Lipovskii, and M. G. Kuzina. Radiokhimiya 2, 301-6(1960). (In Russian)

Spectrophotometric studies were made of plutonyl nitrate complex formation in acetone. The compositions of the complexes and their evolution were determined. The absorption spectra of a complex trinitratoplutonyl compound had complex characteristics and differed considerably from perchlorate and plutonyl nitrate spectra. (R.V.J.)

21380

SPECTROPHOTOMETRIC INVESTIGATION OF PLUTONYL NITRATE COMPLEX FORMATION IN HYDROUS SOLUTIONS AND Pu(VI) EXTRACTION BY DIBUTYL ETHER. V. M. Vdovenko, A. A. Lipovskii, and M. G. Kuzina. Radiokhimiya 2, 307-11(1960). (In Russian)

The formation of complex Pu(VI) compounds in solutions of nitric acid was observed. It was found that Pu(VI) in 11 to 12 N nitric acid appears in a form of plutonyl nitrate and with increased nitric acid the plutonyl trinitrate complex concentration also increases. In hydrous solutions Pu(VI) does not complex with nitrate ions. The stability of Pu(VI) nitrate complex compounds exceeds the stability of the corresponding uranyl complexes. The Pu(VI) distribution between aqueous nitric acid solutions and dibutyl ether was studied. Increased nitric acid in the organic diluent increased the concentration of complex plutonyl trinitrate. (R.V.J.)

21381

FORMATION OF COMPLEX COMPOUNDS OF NEPTUNYL TRINITRATE. V. M. Vdovenko, A. A. Lipkovskii, and M. G. Kuzina. Radiokhimiya 2, 312-14(1960). (In Russian)

Formation of complex neptunyl in acetone using pyridine nitrate as the NO_3^- group donor was investigated by spectrophotometric methods, and the formation of a complex trinitrate neptunyl compound was observed. An increase in the Np(VI) distribution coefficient between aqueous solution and dibutyl ether with increased nitric acid concentration is related to the formation of the complex trinitrate. (R.V.J.)

21382

ON THE EXISTENCE OF URANYL MONOACETATE IN SOLUTION. B. P. Nickol'skii, V. B. Kolychev, A. L. Grekovich, and V. I. Paramonov. Radiokhimiya 2, 330-8 (1960). (In Russian)

The formation of a uranium(VI) complex in small concentrations of acetate (~3.5×10^{-3}M) was studied by ion exchange, pH meter, and spectrophotometric methods. In addition to the uranyl ion, $(UO_2Ac)^+$ ions were found. With concentrations of acetate over 3.5×10^{-3} M, complex cations with larger Ac content were observed. The mean instability constant K for $[UO_2Ac]^+$ determined by all three methods was 3.7×10^{-3}. (R.V.J.)

21383

ORGANIC COPRECIPITANTS. XIII. COPRECIPITATION OF PLUTONIUM(IV). V. I. Kuznetsov and T. G. Akimova. Radiokhimiya 2, 357-63(1960). (In Russian)

A method is suggested for plutonium coprecipitation as a nitrate anion $Pu(NO_3)_6^{2-}$ with podamine B (butyl rodamine) nitrate butyl ether. Quantitative precipitation occurs simultaneously with the separation of large quantities of other elements excluding U(IV), Th, and Ce(IV). Quantitative coprecipitation of plutonium under the action of methyl violet and methyl blue can be achieved with corresponding pH. (R.V.J.)

21384

DETERMINATION OF AMMONIUM PLUTONYL CARBONATE SOLUBILITY IN VARIOUS AQUEOUS SOLUTIONS. L. E. Drabkina. Radiokhimiya 2, 377-8(1960). (In Russian)

The solubility of ammonium plutonyl carbonate in various aqueous solutions of $(NH_4)_2CO_3$, NH_3NO_3, and mixed $(NH_4)_2CO_3 - NH_4NO_3$ was determined and tabulated. It was found that ammonium plutonyl carbonate solubility varies according to the rule of derivatives. (R.V.J.)

21385

INFRA-RED SPECTRA OF THE COMPLEXES OF TITANIUM AND ZIRCONIUM TETRAHALIDES WITH ORGANIC LIGANDS. I. PYRIDINE COMPLEXES. G. S. Rao (Univ. of Saugar, India). Z. anorg. u. allgem. Chem. 304, 176-80(1960) May. (In English)

The infrared spectra of pyridine complexes of titanium and zirconium tetrahalides were measured with sodium chloride and potassium bromide optics. The comparative shifts in the absorption bands obtained on passing from the spectrum of the pure ligand to the complexes are discussed. (auth)

21386

ION EXCHANGE SEPARATION OF SOME LIGHT RARE EARTHS BY ELUTION WITH SODIUM TRIPHOSPHATE. II. EFFECT OF p_H OF ELUANT. P. R. Subbaraman, K. S. Rajan, and J. Gupta (National Chemical Lab., Poona, India). Z. Anorg. u. allgem. Chem. 304, 191-5(1960) May. (In English)

Separation of light rare earths by elution with sodium triphosphate in the p_H range 5 to 8 was studied. Satisfactory resolutions of Sm–Nd and Pr–La concentrates are obtained with a 0.2% eluant at p_H 6. Fractionation of the Nd–Pr pair is poor. In general separations at this higher p_H are not as clear-cut as at p_H 3.6, but have the advantage of a considerable saving in the consumption of triphosphate. (auth)

21387

RADIOCHEMICAL DETERMINATION OF THE CATION EXCHANGEABILITY OF CLAY MINERALS. H.-P. Boehm and K. H. Lieser (Technische Hochschule, Darmstadt, Ger.). Z. anorg. u. allgem. Chem. 304, 207-17(1960) May. (In German)

The ion exchange behavior of kaolinite and illite was studied with solutions of Ag^+, Sr^{2+} and Y^{3+} ions labeled with Ag^{110}, Sr^{90} and Y^{90}, respectively. The observed ion exchange capacities are in good agreement with values obtained by conventional methods. An extremely high selectivity of kaolinite for Y^{3+} ions was observed when Sr^{2+} and Y^{3+} ions were offered simultaneously. The proportion of Y^{3+} : Sr^{2+} ions taken up from solutions of equal normality for both ions is 10^3 or higher. (auth)

Analytical Procedures

21388 AERE-AM-65

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE DETERMINATION OF RADIOBARIUM. G. J. Hunter and M. Perkins. May 1960. 12p. BIS.

The separation of radiobarium with inactive barium carrier involves their combined precipitation with strontium as the nitrates in fuming nitric acid, scavenging with ferric hydroxide, and the precipitation of barium chromate. After dissolution of the chromate, barium chloride is precipitated from a hydrochloric acid–ether mixture. Finally, barium carbonate is precipitated and counted. (auth)

21389 AERE-M-678

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DIFFERENTIAL SPECTROPHOTOMETRIC DETERMINATION OF PLUTONIUM IN ROUTINE USE. G. Phillips. May 1960. 10p. BIS.

The determination of plutonium by differential spectrophotometry using the plutonium(III) color is presented from the point of view of its suitability for use as a routine method of analysis. The range of plutonium concentration to which the method is applicable was defined as 1.5 to 14.0 mg/ml. The accuracy and precision of results obtained were shown to be comparable with accepted gravimetric and volumetric techniques. (auth)

21390 AFCRC-TR-59-139

Nuclear Science and Engineering Corp., Pittsburgh.

ACTIVATION ANALYSIS HANDBOOK. R. C. Koch. Dec. 15, 1958. 241p. Contract AF19(604)-2214. (AD-214941).

A collection of nuclear data and experimental methods for activation analysis is presented in a form convenient for reference purposes. The collation of data was performed element by element, with respect to the trace elements to be assayed. The tabulation consists of categories of information on nuclear data, experimental methods, evaluation of nuclear reactions, standard sensitivities, and references. (J.R.D.)

21391 CEA-1386

France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucléaires, Saclay.

APPLICATION DE LA CHROMATOGRAPHIE A L'ANALYSE DES MELANGES GAZEUX EXTRAITS DES METAUX PAR FUSION REDUCTRICE SOUS VIDE. (Application of Chromatography to the Analysis of Gaseous Mixtures Extracted from Metals by Reductive Fusion under Vacuum). C. Baque and L. Champeix. 1959. 21p.

Mixtures of hydrogen, carbon monoxide, and nitrogen extracted from metals by reductive fusion under vacuum are normally analyzed by conventional methods using the selective absorption of the components after eventual transformation, on reagents which are generally solid. The new techniques of gas phase chromatography have led to the development of a method of analysis which is more accurate and above all much faster. Using a comparatively simple apparatus, the three components are efficiently separated by a column filled with "Linde molecular sieve." Calibration curves giving the volumes of gas as a function of the peak height were drawn for each component. The method as a whole is examined with regard to its reproducibility, sensitivity, and accuracy. (auth)

21392 CEA-1425

France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucleaires, Saclay.

DISPOSITIF D'ÉVAPORATION POUR LA MESURE RATIONNELLE DE LA RADIOACTIVITÉ DE L'EAU. (Evaporation Equipment for the Rational Measurement of the Radioactivity of Water). H. Hasenjäger. 1960. 24p.

An apparatus is described whereby the water can be evaporated directly in the radioactive sample holder in which the sample is counted. Rapid evaporation is obtained by the heating of the dish combined with the application of a jet of hot air. Liquid is added to the dish and the heating stopped automatically at the end of evaporation. The speed of evaporation and the losses in activity as a function of the degree of heating were studied for various substances and different qualities of water (permuted water, tap water,

rainwater). Complexones are added to avoid losses of activity. (auth)

21393 CEA-1527

France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucleaires, Saclay.

MESURE DE LA TENEUR D'UN PLUTONIUM EN ^{240}Pu PAR LA METHODE DES FISSIONS SPONTANEES. (Measurement of the Pu^{240} Concentration of a Plutonium Sample by the Spontaneous Fission Method). R. Caizergues and C. Clouet d'Orval. 1960. 62p.

It is very important to know the plutonium-240 content of the plutonium formed in piles. The method of measurement described here consists in counting the number of spontaneous fissions produced in a known quantity of plutonium. This measurement is carried out in a multiple-plate ionization chamber, the plutonium being deposited on the plates. The disintegration constant of plutonium-240 by spontaneous fission being known the plutonium-240 content in the sample can be calculated. (auth)

21394 KAPL-M-DPS-3

Knolls Atomic Power Lab., Schenectady, N. Y.

THE POLAROGRAPHIC DETERMINATION OF NIOBIUM IN ZIRCONIUM BASE ALLOYS. D. P. Stricos. June 24, 1960. 9p. Contract W-31-109-Eng-52. OTS.

A polarographic method was developed for the analysis of niobium in zirconium base alloys containing tin. A sample was dissolved in a mixture of sulfuric, hydrochloric and fluoboric acids and fumed with sulfuric acid. The resulting sulfuric acid solution was diluted to volume, and the niobium was determined from its peak at −0.950 v vs. SCE using a cathode ray polarograph. (auth)

21395 KY-349

Union Carbide Nuclear Co. Paducah Plant, Ky.

IMPROVED U^{235} MEASUREMENTS AT THE PADUCAH PLANT THROUGH REFINEMENTS IN THE GRAVIMETRIC OXIDE DILUTION PROCEDURE. R. F. Smith, R. E. Eby, and C. W. Turok. July 26, 1960. 15p. Contract W-7405-eng-26. OTS.

Refinements were accomplished in all three major steps of the procedure for precise measurement of U^{235}; those being oxide mixing, fluorination, and spectrometer analysis. Synthetic isotopic standards were first prepared in 1945 at the Oak Ridge Gaseous Diffusion Plant operated by Union Carbide Nuclear Company, and various applications of the procedure have since been reported. Recently, the Paducah Plant evaluated the variability of such standards by devising a quality control program whereby spectrometer analytical variability was overwhelmed. Various procedures have been reported for converting uranium salts to UF_6. Recent contributions by the Paducah Plant were a new sample tube to minimize isotopic contamination and a high pressure-high temperature (HP-HT) fluorination system to improve yield. Spectrometer analytical precision was improved at Paducah by the use of a small inlet system with minimum exposed surface area, a single inlet leak adapted for automatic intensity control, and individual spectrometer memory corrections. With the refinements enacted, UF_6 with an assay of 0.038 wt.% U^{235} may be analyzed isotopically to an absolute precision of ±0.00003 wt.% relative to unaltered uranium. Precisions in the order of 0.02% of the assay, relative to unaltered uranium, are attainable on UF_6 with an assay of 1.9 wt.% U^{235}. (auth)

21396 LA-1249

Los Alamos Scientific Lab., N. Mex.

THE POLAROGRAPHIC DETERMINATION OF URANIUM IN THE PRESENCE OF PLUTONIUM. Maynard E. Smith. May 25, 1951. Decl. July 31, 1956. 30p. Contract W-7405-eng-36. OTS.

A polarographic method for the determination of U in the presence of Fe and Pu is described. A 2M hydroxylamine hydrochloride solution is used as the supporting electrolyte. This solution reduced the Pu to Pu^{3+} without reducing the U. The U is determined polarographically by difference in uranyl reduction wave height [U(VI) to U(V)] at −0.35 v. Solutions with a U/Pu weight ratio as low as 3.5×10^{-3} were analyzed with an error of less than 2%. (C.J.G.)

21397 LMSD-288231

Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.

BERYLLIUM ANALYZED FOR TRACE IMPURITIES BY GAMMA-RAY ACTIVATION. W. Bradshaw, R. Johnson, and D. Beard. Jan. 1960. 27p. Contract NOrd-17017.

This paper was originally printed under the same title in Vol. II, "Metallurgy and Chemistry," of General Research in Materials and Propulsion, January 1959–January 1960. LMSD-288140.

A gamma activation method for the determination of C, O, and N in Be was developed. With a precision of 20%, the method can detect trace quantities of 10 to 5000 ppm O and 100 to 25,000 ppm C. After activation of the sample, O and C activities decay through positron emission which is detected by coincidence-counting techniques. (C.J.G.)

21398 ORO-307

Texas. Agricultural and Mechanical Coll., College Station. Engineering Experiment Station.

COMPUTER TECHNIQUES FOR RADIOACTIVATION ANALYSIS. Annual Report. W. E. Kuykendall, R. E. Wainerdi, J. C. Mitchell, B. C. Moore, R. L. Smith, Jr., E. N. Roots, Jr., J. Shanks, D. W. Hood, and B. Buglio. May 1, 1960. 127p. Contract AT(40-1)-2565. OTS. (TEES-2565-1).

A major factor delaying the development of radioactivation analysis as a routine analytical tool is the large number of sequential, interdependent operations which are inherent in the various phases of the technique. These phases include the irradiation, the spectral measurement, and the handling of large volumes of data resulting from the measurements. An automatic system was developed which will permit the rapid activation, counting, and the handling of data resulting from radioactivation analysis of samples containing large numbers of constituents. The computer programs, both analog and digital, which are necessary for the handling of this data, were completed and tested; as has an anticoincidence gamma spectrometer specially designed for this application. An automatic sample-handling device is currently under design and is being built to complete the automated radioactivation analysis system. In addition to accelerating the handling of data, the use of high-speed computers enhances the accuracy of radioactivation analysis through the application of statistical tests to the data, tests which could not be applied manually without a significant loss of time. Rapid mechanical sample preparation, irradiation, and counting techniques are necessary to permit the accumulation of the input data for the computer if full advantage is to be taken of the computer's very great data-handling speed. The factors which insure the production of meaningful data include: the physical and nuclear characteristics of the sample, the precise positioning and re-positioning of the sample, the necessary re-counting frequency, the irradiation dosage characteristics, both in dose rate and flux level, the stability of the amplifiers and other electronic devices

in the system, and the characteristics of the spectroscopy crystal, among many others. The activating radiation source, the counting system, the multi-channel analyzer, and the computer may be altered to suit particular applications since the computer programs are written so that they may be easily translated. Thus far, an AGN 201 reactor neutron source, an Argonne design 256-channel analyzer with an anti-coincidence gamma detector, and both an IBM 704 digital computer and a 40-amplifier analog computer (the EESEAC) were used. The sophistication which is necessary for the automated system depends upon the extent of uncertainty in the sample composition, the nuclear properties of the activation targets product, and the number of components present. The memory of the digital computer and its speed in recalling stored information determine the rapidity with which it can handle data. The nuclear properties of the composite sample govern the required waiting intervals between countings, as well as the minimum permissible activation time; and thus, the sample properties determine the minimum over-all sample analysis time. The combination of a neutron source, a computer, and a gamma spectrometer will permit the rapid analysis of large numbers of samples to very high orders of sensitivity on an automated basis. (auth)

21399 PGR-99(W)

United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England.

ANALYTICAL METHOD FOR THE DETERMINATION OF STRONTIUM-89 AND STRONTIUM-90 IN URINE. Apr. 1960. 15p. BIS.

The sample, together with added strontium carrier, is evaporated in the presence of nitric acid, ashed, and the residue dissolved in acid. The strontium, together with the calcium naturally present, is precipitated as phosphate. The separated strontium is purified and separated from calcium, being finally precipitated as carbonate, mounted and the β-activity measured with a Geiger-Mueller tube. Yttrium-90 is allowed to grow in, separated, and its activity measured. (auth)

21400 RFP-194

Dow Chemical Co. Rocky Flats Plant, Denver.

THE IMPURITY ANALYSIS OF AMERICIUM SOLUTIONS. A. J. Johnson and E. Vejvoda. Apr. 20, 1960. Changed from OFFICIAL USE ONLY May 19, 1960. 26p. Contract AT(29-1)-1106. OTS.

A solution d-c arc method was developed for the impurity analysis of americium solutions which are 3 to 5 M in ammonium thiocyanate. (auth)

21401 UWFL-68

Washington. Univ., Seattle. Lab. of Radiation Biology.

THE ANALYSIS OF SOME TRACE ELEMENTS IN FISH TISSUES. Timothy Joyner and Diptiman Chakravarti. Apr. 25, 1960. 15p. Contract AT(45-1)-540. OTS.

The determination of nickel, manganese, cobalt, copper, iron, and zinc by the initial separation of their chloride complexes with a strongly basic anion-exchange resin, followed by colorimetric analyses, appears promising as a method for studying the occurrence of these trace metals in fish tissues. The procedure should also be applicable to fresh-water analysis. The determinations for nickel and manganese in fish bone were hindered by the large amount of ash. The removal of calcium before separating the trace metals is recommended. (auth)

21402 TT-880

APPLICATION OF THE POLAROGRAPHIC METHOD TO THE ANALYSIS OF SYNTHETIC PHOSPHORS WITH A NOTE ON THE ESTIMATION OF PALLADIUM. (REPORT NO. 1). Shinichiro Hakomori and Takashi Tashiro. Translated by K. Shimizu (National Research Council of Canada) from Denki Kagaku Kyokaishi 2, 15-18(1934). 12p. JCL.

The polarographic method was applied to the analysis of the substrate (sulfides of alkaline earth metals), the active agent (Bi, Cu, Mn, Ni, and other heavy metals), and the solvent (salts of alkaline metals) of synthetic phosphors. Methods are presented for the quantitative determinations of the active agents Bi, Zn, and Pd and the solvent NaCl. (C.J.G.)

21403

USE OF N, N-DIACETYLANTHRANILIC ACID AS REAGENT IN CHELATOMETRY. II. DIRECT CHELATOMETRIC TITRATION OF THORIUM WITH PYROCATECHOL VIOLET. C. Drăgulescu, T. Simonescu, and R. Anton. Acad. rep. populare Romîne, Baza cercetări ştiinţ. Timişoara, Studii cercetări, Ştiinţe chim. 6, 29-34(1959) Jan.-June. (In Rumanian)

A new method for the direct chelatometric titration of thorium with N, N-diacetylanthranilic acid and Pyrocatechol Violet is established. The method is fast, selective, and precise. It permits the determination of thorium at concentrations of 0.1 to 5 mg in 100 cm^3 with errors between 0.5 to 1%. (tr-auth)

21404

DETERMINATION OF BORON IN MINERALS BY THE DETECTION OF α PARTICLES FROM THE REACTION $B^{10}(n,\alpha)Li^7$. M. Fîti, C. Mănţescu, and T. Costea. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 423-30(1960). (In Rumanian)

A fast and precise method for the determination of boron in minerals by the detection of α particles from the $B^{10}(n,\alpha)$ reaction is presented. The α detection is made simultaneously with the irradiation by thermal neutrons. The method is sufficiently fast for the analysis of minerals on an industrial scale. Because of it precision and sensitivity it is applicable to the determination of traces of B in very pure materials. In this case an intense thermal neutron flux must be employed. (tr-auth)

21405

DIRECT SPECTROGRAPHIC DETERMINATION OF URANIUM IN RESIDUES OBTAINED AFTER LEACHING THE ORES. Zofia Radwan and Bozena Stryzewska (Inst. for Nuclear Research, Polish Academy of Sciences, Warsaw). Chem. Anal. (Warsaw) 3, 737-44(1958). (Translated from Referat. Zhur. Fiz. No. 11, 1959, abstract No. 26257)

A method was developed for spectrographic determination of U in residues obtained after leaching the ores; the residues contain considerable amounts of SiO_2, Al, Fe, Ca, Ma, and 0.01 to 0.1% of U. A Hilger spectrograph was used (dispersion 5.8 A.mm) together with an a-c arc. The determinations were made by the three-standard method. The spectral lines U 4241.7 and 4090.1 Å were investigated.

21406

SPECTRAL DETERMINATION OF IMPURITIES IN URANIUM OXIDE BY THE METHOD OF FRACTIONAL DISTILLATION WITH CARRIER. Julian Czakow, Leon Pszonicki, and Zofia Walewska (Inst. for Nuclear Research, Polish Academy of Sciences, Warsaw). Chem. Anal. (Warsaw) 3, 753-60(1958). (Translated from Referat. Zhur. Fiz. No. 11, 1959, abstract No. 26250)

Application of the method of Scribner and Mullin for a semi-quantitative determination of impurities in U_3O_8 is described. The carrier used was AgCl. Analytic lines and data are given on the absolute sensitivity of the method for 14 elements.

21407

MEASURING METHOD FOR THE PURITY OF NATURAL URANIUM. I. QUANTITATIVE SPECTRO-CHEMICAL ANALYSIS OF BORON, IRON, ALUMINUM, MAGNESIUM AND MANGANESE IN URANIUM-BASE MATERIALS. Hiroshi Kawaguchi, Tokunosuke Nakajima, and Masao Takahashi. Denki Shikensho Ihô 22, 175-81(1958).

The carrier-distillation method developed by B. F. Scribner and others was investigated. Uranium samples were converted to U_3O_8 and Ga_2O_3 was added as a carrier (2 parts Ga_2O_3, 98 parts U_3O_8). Then the mixture was charged into a deep cup of graphite and excited in a d-c arc (10 a). B, Fe, Al, Mg, and Mn were determined quantitatively down to 0.08, 7, 23, 2, and 6 ppm, respectively, but their detection limits were attained at even lower levels. One of the difficulties encountered in this procedure lies in the conversion process of uranium samples having various chemical forms. The procedure was investigated in detail, but the behavior of traces of boron was not completely understood. Practically this difficulty was circumvented by resembling the conversion conditions for the samples as closely as those for standard samples. Repeated results of spectrographic procedure for B, Fe, Al, Mg, and Mn agreed within 5 to 10%. (auth)

21408

MEASURING METHOD FOR THE PURITY OF NATURAL URANIUM. II. QUANTITATIVE DETERMINATION OF RARE EARTH ELEMENTS IN URANIUM. Hiroshi Kawaguchi, Tokunosuke Nakajima, and Masao Takahashi. Denki Shikensho Ihô 22, 181-5(1958).

To avoid interference from uranium lines in the spectrographic determination of rare earth elements in uranium compounds, the uranium was removed by an ether extraction, precipitation as fluorides, and purification by way of the hydroxides. La was used as a carrier in this chemical procedure. Four rare earth elements, Y, Dy, Gd, and Sm were investigated and their limits of detection—sensitivity—were reported. Their recoveries from the uranium were examined by way of tracer techniques with $Eu^{152+154}$. (auth)

21409

RADIOMETRIC MICROMETHOD FOR QUANTITATIVE DETERMINATION OF METAL IONS. Ernst Schumacher and Walter Friedli (Universität, Zurich). Helv. Chim. Acta 43, 1013-18(1960). (In German)

An analytical method for μg quantities of metals is reported which depends on the following principle: the metal ion M, concentration M_t, is mixed with a weightless amount M* of a radioisotope; then a ligand L (concentration L_t) is added whereby $L_t < M_t$. M is partially transferred in the complex ML which can be separated from excess M under certain conditions. From known concentrations of L and the stoichiometry of the complex formation, M_t can be determined. Application of the method to Co and Tb with EDTA is described. (T.R.H.)

21410

ON THE INVESTIGATIONS OF MIXED RADIOACTIVE ELEMENTS BY THRESHOLD SPECTROMETERS. R. M. Kogan and Sh. D. Fridman (Inst. of Applied Geophysics, Academy of Sciences, USSR). Izvest Akad. Nauk S.S.S.R., Ser. Geofiz. No. 6, 809-17(1960) June. (In Russian)

Selecting the most efficient discrimination levels for multicomponent analysis by threshold spectrometers is discussed. The most suitable correlation levels E and E_2 are suggested for the γ emission of uranium—thorium deposits investigated by threshold spectrometers with various sizes of NaI(Tl) crystals. The interference of K^0 emission is evaluated. (R.V.J.)

21411

TRITIUM-LABELED COMPOUNDS. V. RADIOASSAY OF BOTH CARBON-14 AND TRITIUM IN FILMS, WITH A PROPORTIONAL COUNTER. Horace S. Isbell, Harriet L. Frush, and Nancy B. Holt. J. Research Natl. Bur. Standards 64A, 363-7(1960) July-Aug.

A convenient procedure is described for the radioassay of both carbon-14 and tritium in water-soluble, nonvolatile compounds by means of a windowless, gas-flow, proportional counter. The materials are counted in uniform films of sodium O-(carboxymethyl)cellulose that are "infinitely thick" to the radiation of tritium but not to the radiation of carbon-14. Films of uniform thickness are obtained by new techniques which are described in detail. If only carbon-14 is present, its absolute activity can be calculated conveniently by means of an empirically established curve for the counting-efficiency. If both carbon-14 and tritium are present, the films are counted in the proportional counter and are then recounted in the presence of a screen that stops all radiation from tritium but only a portion of that from carbon-14. From a film with a thickness of 0.8 mg/cm^2, approximately 43 percent of the radiation of carbon-14 is counted. Of this emerging radiation, approximately 50 percent passes through a screen of ¼-mil double-aluminized "Mylar." By use of suitable calibration curves for counting-efficiency, carbon-14 and tritium in the same sample can be calculated from the counts with, and without, the screen. Satisfactory analyses can be made with samples containing less than 0.001 microcurie of carbon-14 and 0.005 microcurie of tritium. The method is suitable for the radioassay of a wide variety of labeled materials. (auth)

21412

NON-DESTRUCTIVE ANALYSIS OF SELENIUM BY NEUTRON ACTIVATION FOLLOWED BY GAMMA-RAY SPECTROMETRY. Minoru Okada (Government Chemical Industrial Research Inst., Tokyo). Nature 187, 594-5(1960) Aug. 13.

Samples of Se (0.1 to 0.5 g) were irradiated by a neutron flux of 3×10^{11} neutrons/cm^2/sec for 20 sec, cooled for 15 sec, counted for 20 sec, again cooled for 20 sec, and counted for 20 sec. Gamma scintillation spectrometry gave only one photopeak of energy 0.155 to 0.17 Mev and half life 17.5 sec, identical with those of Se^{77m}; thus, this method is suitable for Se determination by neutron activation. (D.L.C.)

21413

USE OF AZO DYESTUFFS FOR THE POLAROGRAPHIC DETERMINATION OF THE LANTHANIDES. T. M. Florence and L. E. Smythe (Australian Atomic Energy Commission, Lucas Heights, New South Wales). Nature 187, 771-2 (1960) Aug. 27.

The polarographic behavior of some 2,2′-dihydroxy azo dyes in the presence of the lanthanides was studied. These dyes all exhibited well defined single polarographic reduction waves. In ammonia, diethanolamine, and piperidine buffers, the lanthanides caused a decrease in the height of the dye steps, and a second wave appeared at a more negative potential. The height of the second wave was proportional to the concentration of lanthanide. In the ammonia buffer, the difference in the half-wave potentials increased with increasing atomic number of the lanthanides. (M.C.G.)

21414

UTILISATION OF TERNARY AND ION-ASSOCIATION COMPLEXES IN CHEMICAL ANALYSIS. II. POLARO-

GRAPHIC DETERMINATION OF INDIUM. Miloslav Kopanica and Rudolf Přibil (Chemical Inst., Czechoslovak Academy of Sciences, Prague). Talanta 4, 158-65(1960) May.

Conditions were found for the formation of phenanthroline-thiocyanate complexes of indium, cadmium and other metals and their compositions were determined. The influence of EDTA on the formation of these complexes was observed. At pH 3 indium remained bound in the soluble EDTA complex, while cadmium, zinc, copper, and other ions formed water-soluble phenanthroline-thiocyanate complexes which were separated from the aqeuous phase into butanol. It was then possible, after acidification with hydrochloric acid, to determine indium polarographically in the aqueous phase. Using this method it is possible to determine from 0.05% of indium in metallic cadmium. (auth)

21415

2:5-DIHYDROXY-p-BENZOQUINONE AS AN ANALYTICAL REAGENT FOR THE GRAVIMETRIC DETERMINATION OF THORIUM AND ZIRCONIUM. B. D. Jain and S. P. Singhal (Delhi Univ.). Talanta 4, 178-81(1960) May.

2,5-Dihydroxy-p-benzoquinone precipitates thorium alone and completely from 1N hydrochloric acid solution even in presence of large quantities of cerium^{+3} and cerium^{+4}, lanthanum, and uranium. It also precipitates zirconium alone and completely from 1N hydrochloric acid solution in presence of titanium^{+4}. The precipitate in each case can be ignited to oxide and weighed. (auth)

21416

THE DETERMINATION OF TANTALUM IN ROCKS BY NEUTRON-ACTIVATION ANALYSIS. D. F. C. Morris and A. Olya (Brunel Coll. of Tech., London). Talanta 4, 194-200(1960) May.

Neutron-activation analysis was applied to the determination of traces of tantalum in rocks. Radiochemical separations, after the addition of carrier, were based mainly on precipitations of tantalum as the hydrous oxide and on solvent extraction with tri-n-butyl phosphate. Radiochemically pure tantalum was finally precipitated as the pentoxide and the chemical yield was determined gravimetrically. In order to avoid errors due to self-shielding, dilute aqueous solutions of tantalum were used as the standards irradiated simultaneously with the analytical samples. Results for the tantalum contents of standard rock samples G1 and W1 are reported. (auth)

21417

A SELF-SAMPLING INDICATOR TUBE FOR OXYGEN. B. E. Dixon and P. R. Kiff (Lab. of the Government Chemist, London). Talanta 4, 203-4(1960) May.

The need for a simple field test for determining the amount of oxygen in the atmosphere led to the development of a self-sampling indicator tube. Air is admitted to an evacuated glass tube containing an intimate mixture of silica gel and manganous oxide by breaking the end. The color of the absorbent changes very rapidly from green to brown and the oxygen content of the atmosphere is determined by measurement of the lengths of green and brown material. This determination can be carried out in less than one minute. (M.C.G.)

21418

FUEL ELEMENT FOR ATOMIC PILE. (to United Kingdom Atomic Energy Authority). French Patent 1,193,261. Apr. 27, 1959.

A fuel element is manufactured by sintering or casting fissile material around the extremity of a stainless steel-enveloped thermocouple cable which, with the exception of the hot junction, is protected against contact with the fissile material by means of a Nb or Ta sleeve. A protective can and end caps are applied, the passage of the cable through the end cap being sealed by means of a mechanical or molten seal. By leading the cable through the conical bottom adapter, it does not interfere with the handling and piling up of the fuel elements. A second thermocouple junction can be inserted in the can wall and its cable united with the other one.

General Inorganic and Physical Chemistry

21419 ANL-6129

Argonne National Lab., Ill.

ANALOG COMPUTER STUDY OF METAL–WATER REACTIONS INITIATED BY NUCLEAR REACTOR TRANSIENTS. R. C. Liimatainen, H. T. Bates, L. C. Just, and N. F. Morehouse, Jr. May 1960. 196p. Contract W-31-109-eng-38. OTS.

A mathematical model to permit an investigation of metal–water reactions using an analog computer was developed. In the first part of the study, four differential equations giving the temperature of the unreacted metal, the temperature of the oxide, the amount of reaction, and the pressure in the vessel as a function of time were solved. In the second part, the temperature in the reacting pin was obtained both as a function of time and position using a finite-difference technique. The chemical reactions were initiated by nuclear reactor transients. Flat-top, exponential, and oscillatory neutron bursts were studied. The model was based on the reaction $U + 2H_2O \rightarrow UO_2 + 2H_2$. Parametric studies were made of the influence of such factors as the chemical kinetic and heat transfer coefficients on the temperatures and extent of reaction. Finally, a comparison of the analog metal–water experiments is made with metal–water experiments conducted in the TREAT nuclear reactor. (auth)

21420 CEA-1363

France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucleaires, Saclay.

PREPARATION DE FLUORURES DE PLUTONIUM POUR L'OBTENTION DE METAL DE HAUTE PURETE. (Preparation of Plutonium Fluoride to Obtain Metal of High Purity). P. Faugeras, A. Brut, and R. Helou. 1960. 24p.

In the process of treating irradiated uranium, plutonium can be separated from the majority of the fission products and from the uranium by TBP extraction cycles. The high purity necessary for metallurgical and nuclear physics experiments led us to consider more elaborate purification processes, and a specially adapted method of fluoride preparation. Purification cycles of plutonium in solution on ion exchange resins are described, and the results are given. The description and results of the fluoride preparation method are also given. (auth)

21421 CEA-1408

France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucleaires, Saclay.

REMARQUES SUR L'ARTICLE DE MM. R. HAUL, H. BEHNKE, H. DIETRICH "DIE MESSUNG VON GLEICHGEWICHTSKONSTANTEN DES DEUTERIUM–AUSTAUSCHES ZWISCHEN SCHWEFELWASSERSTOFF UND WASSER". (Comments on the Article by R. Haul, H. Behnke, H. Dietrich "The Measurement of Equilibrium

Constants of Deuterium Exchange Between Hydrogen Sulfide and Water"). P. Grandcollot and E. Roth. 1960. 9p.

MM. Haul, Behnke, and Dietrich, having determined the isotopic exchange constant between water and hydrogen sulfide at 25°C, obtain a different value from that of the present authors. A comparison of the techniques employed (a method of mass balance versus a direct method) and of the isotopic analysis methods and also checks carried out from the spectrographic data show that determinations of the present authors are appreciably more accurate. (auth)

21422 CEA-Bib-4

France. Commissariat à l'Énergie Atomique, Paris.
PHYSICO-CHIMIE ET CHIMIE MINERALE DANS L'AMMONIAC LIQUIDE. (Physical Chemistry and Inorganic Chemistry in Liquid Ammonia). M. Heuberger and F. Botter. 1959. 37p.

A literature survey is presented of papers as issued between 1943 and 1959 about physical chemistry and inorganic chemistry in liquid ammonia. 422 references. (auth)

21423 CF-59-5-37

[Oak Ridge National Lab., Tenn.].
THERMODYNAMIC PROPERTIES OF DILUTE AQUEOUS HYDROCHLORIC ACID SOLUTIONS AT ELEVATED TEMPERATURES FROM ELECTROMOTIVE FORCE MEASUREMENTS (thesis). Richard Stiles Greeley. May 1959. 139p. OTS.

Submitted to Univ. of Tennessee.

Results of a study of thermodynamic properties of aqueous hydrochloric acid solutions are presented. A hydrogen electrode was used against a silver–silver chloride electrode at 25 to 275°C using hydrogen pressure of about 1 atm. and hydrochloric acid concentrations of 0.005 to 1.0 M. Electromotive measurement techniques are described and resulting data are tabulated. (J.R.D.)

21424 HW-64403

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
PRELIMINARY REPORT ON pH CONTROL BY ION EXCHANGE IN HIGH pH SYSTEMS. Thomas F. Demmitt. Apr. 25, 1960. 13p. Contract AT(45-1)-1350. OTS.

A new concept in cleanup and pH control systems was evaluated. The system consisted of a mixed bed ion exchange unit to effect purification of a portion of the loop water followed by a weakly acidic cation exchange unit to control the pH. Test results indicated that the quality of the effluent water was excellent and that the pH could be maintained at any desired value between 7.0 and 10.0 until the resins were exhausted. The results of the pH control studies conducted with the weakly acidic resin were so encouraging that it was subsequently evaluated in three feed and bleed systems using neutral, high purity feed water. The resin performed satisfactorily and operation in these loops is now routine. (auth)

21425 IDO-14513

Air Reduction Co., Inc., Central Research Labs., Murray Hill, N. J.
DECOMPOSITION OF NITROUS OXIDE FINAL REPORT. Period covered: February 19, 1959–August 18, 1959. J. H. Zufall and H. S. Miller. Aug. 31, 1959. 20p. For Phillips Petroleum Co. Atomic Energy Div. Contract AT(10-1)-205, Subcontract C-214, Modification No. 1. OTS.

The decomposition of N_2O in a reactor tube containing various fixed-bed catalysts was investigated at 200 to 700°C, space velocities of 250, 1250, and 2500 vol. of gas per vol. of catalyst per hr, and various gas mixture compositions. As catalysts, Rh at 500°C and Pd at 650°C both gave satisfactory results. NO_2 was formed with all these catalysts, the amount increasing as the residual N_2O decreased. (C.J.G.)

21426 NAA-SR-4512

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
VAPOR PRESSURE OF THORIUM. A. J. Darnell, W. A. McCollum, and T. A. Milne. Feb. 15, 1960. 18p. Contract AT-11-1-GEN-8. OTS.

The vapor pressure of solid thorium was determined at 1757 to 1956°K by the vacuum evaporation method of Langmuir. The vapor pressure equation for $Th(s) \rightarrow Th(g)$ is $\text{Log } P_{atm} = (-28{,}780/T°K) + 5.991$. (auth)

21427 NAA-SR-5286

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
P-V-T RELATIONSHIPS OF BF_3 GAS. C. R. F. Smith. July 30, 1960. 31p. Contract AT-11-1-GEN-8. OTS.

A generalized equation of state developed by Gouq-Jen Su and Chien-Hou Chang is used for predicting P-V-T behavior of BF_3 at high gas densities. This equation is shown to be superior to several other generalized equations of state. The average absolute deviation of this equation from experimental measurements is 3% up to gas densities of 1.0 g/cc over the temperature range 0 to 75°C. Using this equation, P-V-T behavior of BF_3 is predicted up to 1.2 g/cc at −10 to 500°C. The critical density of BF_3 (unreported in the literature) is estimated to be 0.59 g/cc. (auth)

21428 NBS-6645

National Bureau of Standards, Washington, D. C.
PRELIMINARY REPORT ON THE THERMODYNAMIC PROPERTIES OF SELECTED LIGHT-ELEMENT COMPOUNDS (SUPPLEMENT TO NBS REPORTS 6297 AND 6484). Third Technical Summary Report to the Advanced Research Projects Agency on the Thermodynamic Properties of Light-Element Compounds. Jan. 1960. Amended Apr. 1, 1960. 95p.

Previously published data on the thermodynamic properties of nitrides and carbides of Li, Be, Mg, Al, and Ti are reviewed. Entropies and high-temperature heat capacities were estimated. Data on the thermodynamic properties of graphite, solid and liquid Ti, and N gas are reviewed. Heats of formation are reported for the perchlorates of NH_4, Li, and K. Data on the vapor pressure and degree of dissociation of $AlH_3 \cdot 2N(CH_3)_2$ are given. Studies on the reactions of NH_3 with the hydrides of Al and Be are reviewed. (C.J.G.)

21429 OMCC-HEF-217

Olin Mathieson Chemical Corp., Niagara Falls, N. Y.
PURIFICATION OF LITHIUM CHLORIDE. PILOT PLANT PROCESS. E. L. Sokol, W. Shelton, and W. Ruthel. Oct. 9, 1959. 155p. AMC Project 7-558C. Contract [AF]33(600)-33920. (AD-232956).

A process was developed to remove the impurities from LiCl, principally LiH, $LiBH_4$, and hydrocarbon oils. The crude salt was dissolved in methanol to make a 20% by weight solution and acidified to pH = 5 with anhydrous HCl. During solution and acidification, boron compounds are converted to volatile trimethoxyborane. The insolubles were filtered off, the oil decanted, and the trimethylborane removed by distillation. The LiCl was then crystallized, centrifuged, and dried. The operation of the process on a pilot plant scale is discussed and flowsheets are included. (C.J.G.)

21430 OMCC-HEF-218

Olin Mathieson Chemical Corp., Niagara Falls, N. Y.
PRODUCTION OF LITHIUM IN THE 30,000-AMPERE PRO-

TOTYPE ELECTROLYTIC CELL. J. G. Cecala and R. I. Elliot. Oct. 8, 1959. 180p. AMC Project 7-558C. Contract [AF]33(600)-33920. (AD-232957).

A 30,000-amp electrolytic cell was successfully constructed and operated for the continuous production of Li. The cell was scaled up from a 1,000-amp pilot plant. Design, operation, and performance data on the 30,000-amp cell are given. The freezing and melting of LiCl in the cell are discussed. Pre-electrolysis of the salt was found necessary to remove the chemically bound impurities. Collection of Cl and Li separately was found possible. (C.J.G.)

21431 TID-3905

Brookhaven National Lab., Upton, N. Y.

VACUUM ULTRAVIOLET SPECTROSCOPY. Bibliography. Marjorie Comstock. Aug. 5, 1960. 23p. OTS.

A bibliography containing 364 references is presented on instrumentation and measurements in the vacuum ultraviolet spectral region. (C.J.G.)

21432 TID-6228

National Lead Co. of Ohio, Cincinnati.

ON THE STRUCTURE AND THERMAL DECOMPOSITION OF "AMMONIUM DIURANATE." Karl J. Notz, Melvin G. Mendel, Carl W. Huntington, and Thomas J. Collopy. [195?]. 6p. OTS.

The addition of NH_4OH to an aqueous solution of $UO_2(NO_3)_2$ produced an ammonium precipitate which has previously been referred to as ammonium diuranate (ADU). From analytical studies and calculations of the reaction, it is concluded that the ADU precipitate is probably a mixture of hydrated pyrouranates. A discussion on the possible mechanism by which the pyrouranate structure is formed is contained. (C.J.G.)

21433 TID-6243

Connecticut. Univ., Storrs.

EIGHTH ANNUAL REPORT ON DISTRIBUTION STUDIES BETWEEN MELTS AND SOLID PHASES USING RADIOACTIVE TRACERS. W. C. Orr, R. Ward, L. Katz, T. E. Burgess, and A. E. Plumley. June 30, 1960. 55p. Contract AT(30-1)-1154. OTS.

The exchange of sodium ions between solid aluminosilicates and molten salts was studied with the aid of a sodium-22 tracer. For sodalite ($Na_4Al_6Si_6O_{24}Cl_2$) and noselite ($Na_4Al_6Si_6O_{24}SO_4$), which have the same three-dimensional network structure, the rate of exchange is shown to depend on diffusion in the solid. The sodalite diffusion coefficient, D, is estimated to range from 3.3×10^{-11} cm^2 min^{-1} at 320°C to 12×10^{-11} cm^2 min^{-1} at 400°C. Activation energy for the diffusion of sodium ions in solid sodalite is 12.5 Kcal $mole^{-1}$ and in noselite is 9.7 Kcal $mole^{-1}$. Artificially prepared sodalite exchanges more rapidly than the natural mineral, presumably because it consists of small crystallites that present a larger surface to the liquid phase. Preliminary experiments suggest that the exchange of sodium between solid tungsten bronzes and either molten salts or amalgams can be studied by similar techniques. (auth)

21434 WADD-TR-60-262

Michigan. Univ., Ann Arbor.

THE CHEMISTRY OF BORON HYDRIDES AND RELATED HYDRIDES. R. W. Parry, R. C. Taylor, C. E. Nordman, G. Kodama, H. Schumacher, E. R. Alton, R. Amster, J. C. Carter, C. Cluff, C. W. Heitsch, C. R. Peters, D. E. Shriver, J. R. Weaver, and M. Yamauchi. June 1960. 115p. Project 3048. Contract AF33(616)-5874.

The action of HF on $[H_2B(NH_3)_2]B_3H_8$ does not produce $[H_2B(NH_3)_3]F$ as originally reported. The ionic solid, isolated in small and variable yield from the reaction, was identified as $[H_2B(NH_3)_2]BF_4$. This compound was fully characterized and synthesized by several different routes. Metathesis reactions for synthesizing $[H_2B(NH_3)_2]BH_4$ were refined. A nuclear magnetic resonance study on the cation $[H_2B(NH_3)_2^+]$ and its salts was completed. (auth)

21435 WAPD-TM-215

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

THE PERFORMANCE OF BASE-FORM ION EXCHANGERS FOR pH CONTROL AND REMOVAL OF RADIOISOTOPES FROM A PRESSURIZED WATER REACTOR SYSTEM. G. P. Simon, C. S. Abrams, and W. T. Lindsay, Jr. July 1960. 71p. Contract AT-11-1-GEN-14. OTS.

Laboratory experiments and in-pile loop tests designed to evaluate, explain, and predict the performance of mixed-bed ion exchange columns in the base form for the control of radioisotopes in reactor coolants are summarized. The results of these tests are evaluated with the aid of a simple theory of column performance for absorption of radioactivity decaying ions, based on an approximate model for an ion exchange column. It is concluded that LiOH form resin will perform satisfactorily for both pH control and activity removal and that it is more effective than either KOH resin or NH_4OH resin for these purposes. (auth)

21436 Y-1299

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

PREPARATION OF DENSE, SPHEROIDAL UO_2. R. P. Levey, Jr. May 2, 1960. 25p. Contract W-7405-eng-26. OTS.

Exploratory work performed in search of simplified, dependable methods for producing high-density UO_2 spheroidal shapes are described. The methods used employ precipitations from aqueous media. The size and shape of the agglomerates in these precipitates fix the ultimate size and shape of the fired UO_2 particles. Rounded shapes from 10 microns to 20 mesh were produced having helium density greater than 10.8 g/cc and geometric density greater than 9.5 g/cc. (auth)

21437 JPRS-5089

STUDIES OF THE THERMODYNAMIC PROPERTIES OF COMPOUNDS BY THE METHOD OF EXPLOSION IN A SPHERICAL BOMB. II. HYDROXYL. V. A. Medvedev, V. V. Korobov, and V. F. Baĭbuz. Translated from Zhur. Fiz. Khim. 33, 58-64(1959). 14p. OTS.

The heat of dissociation of water vapor was determined by the method of explosion in a spherical bomb to be 65.5 kcal/mole. The equilibrium constants corresponding to this value were calculated. (C.J.G.)

21438

STUDY ON THE PRECIPITATION OF AMMONIUM URANATES. I. REACTION BETWEEN URANYL NITRATE AND AMMONIA. C. Drăgulescu and I. Julean. Acad. rep. populare Romîne, Baza cercetări ştiinţ. Timişoara, Studii cercetări Ştiinţe chim. 6, 41-50(1959) Jan.-June (In Rumanian)

The mechanism of the precipitation and the composition of the precipitate which results from the reaction between uranyl nitrate and ammonia were studied by potentiometric, conductometric, and analytical methods. It is shown that the ammonium diuranate is not obtained as has been reported in the literature. At the beginning a precipitate with the composition $(NH_4)_2U_7O_{22}$ is formed. However, after the complete precipitation of the uranium, the initial precipitate is transformed into $(NH_4)_2U_4O_{13}$. (tr-auth)

21439

PRECIPITATION OF URANYL SALTS BY AROMATIC

AMINES. C. Drăgulescu and I. Julean. Acad. rep. populare Romîne, Baza cercetări ştiinţ. Timişoara, Studii cercetări Ştiinţe chim. 6, 51-7(1959) Jan.-June. (In Rumanian)

The reactions in aqueous solutions between uranyl nitrate and iodide and some organic amines with basicity constants of the order of magnitude of 10^{-8} (pyridine, quinoline, aniline, and p-toluidine) are studied. These reactions are equilibrium reactions. An excess of base is necessary for the quantitative precipitation of uranyl. The passage from the gelatinous to the crystalline precipitate is favored by heating to boiling for several minutes. In all cases, the product which results has the composition represented by the formula $UO_3 \cdot 2H_2O$. The appreciable solubility of the precipitate does not permit its utilization in analytical procedures. (tr-auth)

21440

THE PURIFICATION OF INERT GASES BY HOT URANIUM. PART II. P. C. Davidge, N. Hodge, and C. N. Stockdale. Brit. Chem. Eng. 5, 566-9(1960) Aug.

The removal of carbon monoxide, carbon dioxide, and oxygen from argon by passage over a bed of hot uranium was investigated. The size of the uranium bed required for impurity removal was calculated for each gas at various temperatures and impurity concentrations. Uranium turnings were used in the purifiers since they allowed considerable variation in packing density. Uranium was compared with a zirconium–titanium alloy for efficiency in carbon monoxide removal. Possible reactions between uranium and carbon monoxide and carbon dioxide were studied. (M.C.G.)

21441

EQUILIBRIUM BETWEEN URANIUM METAL, URANIUM TRICHLORIDE, URANIUM TETRACHLORIDE IN THE FUSED SODIUM CHLORIDE–CALCIUM CHLORIDE BATH. Tadashi Kuroda and Shigeo Hasegawa. Denki Shikensho Ihô 22, 853-5(1958).

The equilibrium between uranium metal, uranium trichloride, and uranium tetrachloride dissolved in a molten melt containing 50 M % sodium and 50 M % calcium chloride was measured under carefully controlled experimental conditions. The trivalent uranium was determined to be 34 wt.% in the melt at 550 to 800°C. The equilibrium constant for the reaction, 3 UCl_4 ($NaCl-CaCl_2$ melt) + U (solid) = 4UCl_3 ($NaCl-CaCl_2$ melt) was calculated, and the uranium concentration and the bath temperature were found to have no effect on the equilibrium in the range of the experiment. (auth)

21442

POLAROGRAPHIC BEHAVIOR OF SODIUM, POTASSIUM AND LITHIUM BOROHYDRIDES. K. N. Mochalov and G. G. Gil'manshin (Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 132, 134-7(1960) May 1. (In Russian)

The polarographic behavior of $NaBH_4$, KBH_4, and $LiBM_4$ was studied using technical (~80%) purity and 98% borohydrides. The anodic wave with $E_{1/2}$ = 0.65 v belonging to the BH_4^- ion was observed in all borides. The position and character of the wave did not vary with concentration. It was observed that the wave height depends on the pH of the medium. In solutions with high pH above 12.5, in which borohydrides are relatively stable, the wave is absent. Therefore, it was concluded that the observed wave belongs not to BH_4^- but to the products of hydrolysis. After filtering gaseous diborane through cooled concentrated solutions of KOH, NaOH, and LiOH, the resulting solutions of hypoboron exhibited the same wave with $E_{1/2}$ = 0.6 v, showing a proportional drop in the wave height. Data show that the analyzed "borohydride" wave is in reality hypoborate. (R.V.J.)

21443

SYNTHESIZED IMPURITY CENTERS IN FUSED SILICA. E. Lell (Bausch and Lomb Optical Co., Rochester, N. Y.). J. Am. Ceram. Soc. 43, 422-6(1960) Aug.

Fused silica was prepared with controlled amounts (0.02 to 2.0%) of aluminum and lithium added. Absorption spectra and thermoluminescence reveal little difference between undoped specimens and those containing Li or Al alone. The simultaneous presence of Al and Li is essential to build up the absorption band at 2.3 ev (520 mμ) and increase the intensity of the bands at 4.1 ev (300 mμ) and 5.7 ev (220 mμ). A dependence between impurities and absorption of the three bands is given. Whereas all specimens show luminescence peaks at 120°C, those containing Al and Li simultaneously show an additional peak at 310°C. (auth)

21444

THE MAGNESIUM–HYDROGEN SYSTEM. J. F. Stampfer, Jr., C. E. Holley, Jr., and J. F. Suttle (Los Alamos Scientific Lab., N. Mex. and Univ. of New Mexico, Albuquerque). J. Am. Chem. Soc. 82, 3504-8(1960) July 20.

The decomposition pressure of magnesium hydride was measured under conditions such that the precision and accuracy of the temperature and pressure measurements could be estimated and the composition of the solid phases determined. The diffusion of hydrogen through the walls of the apparatus and the solubility of hydrogen in the walls was considered. The apparatus and the method of making the measurements are described. The decomposition pressures were converted to fugacities by use of the Beattie-Bridgeman equation of state for hydrogen and fitted to straight lines to give $R \ln f_{H_2} = (-17{,}785 \pm 76)/T + 32.28 \pm 0.45$ and $R \ln f_{D_2} = (-17{,}480 \pm 110)/T + 32.48 \pm 0.17$. Magnesium hydride, MgH_2, was found to be a stoichiometric compound within the limits of error of the measurements. The solubility of hydrogen in magnesium was found to increase from 2 atom % at 440° to 10 atom % at 560°. From these measurements thermodynamic functions for the formation of magnesium hydride and magnesium deuteride were estimated. (auth)

21445

HEAT CAPACITY OF URANIUM TETRAFLUORIDE FROM 1.3° TO 20°K AND THE THERMODYNAMIC FUNCTIONS TO 300°K. CALORIMETER FOR THE RANGE 0.8° TO 20°K. John D. Burns, Darrell W. Osborne, and Edgar F. Westrum, Jr. (Argonne National Lab., Ill.). J. Chem. Phys. 33, 387-94(1960) Aug.

The heat capacity of uranium tetrafluoride was determined from 1.3 to 20°K in an isothermal calorimeter with an integral gas thermometer and vapor-pressure bulb for calibration of a carbon resistance thermometer. The enthalpy, entropy, and free-energy functions were evaluated from these data and previous measurements at higher temperatures. At 298.15°K, the values of $S°$, $(H° - H_0°)/T$, and $-(F° - H_0°)/T$ are 36.25 ± 0.04, 18.08 ± 0.02, and 18.17 ± 0.02 cal $mole^{-1}$ deg^{-1} for uranium tetrafluoride. A Schottky-type anomaly occurs in the heat capacity at 6.4°K, presumably as a consequence of ligand-field splitting of the electronic energy levels. (auth)

21446

STRUCTURE OF THE INFRARED Y BANDS OF N_2. G. H.

Dieke and D. F. Heath (Johns Hopkins Univ., Baltimore). J. Chem. Phys. 33, 432-6(1960) Aug.

The rotational analysis of the n - 4, 3 band of the "Y" system of N_2 shows that the initial state is a $^3\Sigma_u^-$ level with $B_{n-4} = 1.3325$. The band has exactly the structure to be expected from a $^3\Sigma_u^- \rightarrow {}^3\pi_g$ transition and all expected 27 branches have been observed. The triplet separation of the $^3\Sigma$ state degenerates into a doublet for all but the lowest values of K as the two states with $J = K \pm 1$ nearly coincide. (auth)

21447

SEARCH FOR A JAHN-TELLER EFFECT IN IrF_6. Howard H. Claassen and Bernard Weinstock (Argonne National Lab., Ill.). J. Chem. Phys. 33, 436-7(1960) Aug.

An investigation of the vibrational spectra of IrF_6 failed to reveal the anomalies found for OsF_6 that were attributed to a Jahn-Teller coupling. This is taken to indicate that the Γ_8 ground electronic state of IrF_6 has a strong spin character. For the vapor in the NaCl range the observed absorption frequencies (cm^{-1}) and their assignments were: 720 (σ_3), 852 ($\sigma_2 + \sigma_6$), 921 ($\sigma_2 + \sigma_4$), 979 ($\sigma_1 + \sigma_4$), 1364 ($\sigma_2 + \sigma_3$), and 1425 ($\sigma_1 + \sigma_3$). A Raman shift of 651 cm^{-1} ascribed to σ_2 was obtained for a solution of IrF_6 in n-C_7F_{16}. (auth)

21448

ON THE DISSOCIATION OF POLYATOMIC MOLECULES. Robert J. Rubin and Kurt E. Shuler (National Bureau of Standards, Washington, D. C.). J. Chem. Phys. 33, 438-43(1960) Aug.

The dissociation of a simple model of a linear four-atomic molecule is treated classically by considering the motion of configuration points in the configuration space of the molecule. The usual configurational criterion for dissociation, i.e., the crossing of a critical surface in configuration space, is used. The specific problem studied is the effect of the recrossing of a critical surface by a configuration point corresponding to the "healing" of a "dissociated" bond. It is shown that, for the model considered, the above effect results in a greater probability of breaking of the exterior bonds as compared to the interior one. (auth)

21449

INTERACTION ENERGIES FOR THE $H-H_2$ AND H_2-H_2 SYSTEM. Joseph T. Vanderslice and Edward A. Mason (Univ. of Maryland, College Park). J. Chem. Phys. 33, 492-4(1960) Aug.

Interaction energies for the $H-H_2$ and H_2-H_2 systems were obtained by a semiempirical perfect-pairing procedure. The results were compared with interaction energies obtained from other sources and the agreement among the different curves is reasonably good. A brief discussion of the previous applications of this semiempirical scheme to other systems is included. (auth)

21450

RELATIVE QUENCHING CROSS SECTIONS IN THE REACTION OF $Hg(6^3P_1)$ ATOMS WITH ISOTOPIC N_2O MOLECULES. Morton Z. Hoffman and Richard B. Bernstein (Univ. of Michigan, Ann Arbor). J. Chem. Phys. 33, 526-9 (1960) Aug.

The N^{14}/N^{15} and O^{16}/O^{18} isotope effects in the $Hg(6^3P_1)$-photosensitized decomposition of nitrous oxide were measured. Observed isotopic fractionation factors, S^0 (interpreted in terms of ratios of rate constants for quenching by $N^{14}N^{14}O^{16}$ vs $N^{15}N^{14}O^{16}$, $N^{14}N^{15}O^{16}$ and $N^{14}N^{14}O^{18}$), are related to the ratio of isotopic quenching cross sections by the equation $Q/Q^* = S^0(\mu/\mu^*)^{1/2}$, where μ and μ^* are the collisional reduced masses for Hg and the light and heavy isotopic molecules, respectively. The quenching cross section ratio for $N^{14}{}_2O^{16}/N^{14}{}_2O^{18}$ was unity within the experimental uncertainty (±0.1%). The ratios for $N^{14}N^{14}O^{16}/N^{15}N^{14}O^{16}$ and $N^{14}N^{14}O^{16}/N^{14}N^{15}O^{16}$ differed from unity by +0.98 and +0.44%, respectively. The order of the quenching cross sections for the isotopic nitrous oxide molecules is thus: $N^{15}N^{14}O^{16} < N^{14}N^{15}O^{16} < N^{14}N^{14}O^{18} \cong N^{14}N^{14}O^{16}$. The implications of the present observations are briefly discussed. (auth)

21451

HETEROGENEOUS REACTIONS STUDIED BY MASS SPECTROMETRY. I. REACTION OF B_2O_3(S) WITH H_2O(g). David J. Meschi, William A. Chupka, and Joseph Berkowitz (Argonne National Lab., Ill.). J. Chem. Phys. 33, 530-3 (1960) Aug.

Knudsen effusion and mass-spectrometric techniques were employed in studying the gaseous species in thermodynamic equilibrium with condensed boric oxide and water vapor in the temperature range from 1060 to 1450°K. Water vapor was introduced into a Knudsen cell containing B_2O_3, and the vapor effusing from the cell was analyzed mass spectrometrically. The ions H_2O^+, HBO_2^+, $H_3BO_3^+$, and $(HBO_2)_3^+$ were observed. Of the various boron-containing species in equilibrium with the system, the one present in largest amounts was found to be HBO_2. $\Delta H_0°$ for the reaction $\frac{1}{2}H_2O(g) + \frac{1}{2}B_2O_3$(l or s) $\rightarrow HBO_2(g)$ was calculated to be 47.6 ± 2.0 kcal/mole. The data pertaining to the trimer $(HBO_2)_3$ are rather poor, but, in the temperature range covered, its concentration was less than 1% of that of the monomer HBO_2, and at the highest temperature (1450°K) was approximately equal to the concentration of H_3BO_3. A crude calculation of the heat of formation of the trimer by means of the third law gives $\Delta H_0°(f) \approx -540 \pm 10$ kcal/mole. (auth)

21452

HETEROGENEOUS REACTIONS STUDIED BY MASS SPECTROMETRY. II. REACTION OF Li_2O(s) WITH H_2O(g). Joseph Berkowitz, David J. Meschi, and William A. Chupka (Argonne National Lab., Ill.). J. Chem. Phys. 33, 533-40(1960) Aug.

The reaction of water vapor with lithium oxide was studied by a mass-spectrometric technique. In the temperature range 1100 to 1400°K and with water vapor pressures of the order of 0.1 mm, the major reaction product in the vapor phase was LiOH. Smaller amounts of $Li_2(OH)_2$ and traces of $Li_3(OH)_3$ were measured. Various equilibria among the above species were studied with the use of isotopic substitution for lithium and hydrogen. The decomposition of lithium hydroxide was studied in the temperature range 500 to 600°K. Structural parameters and vibrational frequencies were estimated and thermodynamic functions were calculated for the LiOH and $Li_2(OH)_2$ molecules. The following heats of reaction, which are consistent within experimental error, were then determined: $Li_2O(s) + H_2O(g) \rightarrow 2LiOH(g)$, $\Delta H_{1300}° = 79.0 \pm 2.0$ kcal; $Li_2O(s) + H_2O(g) \rightarrow Li_2(OH)_2(g)$, $\Delta H_{1250}° = 15.0 \pm 2.0$ kcal; $Li_2(OH)_2(g) \rightarrow 2LiOH(g)$, $\Delta H_{1300}° = 60.0 \pm 3.0$ kcal; $2LiOH(s) \rightarrow Li_2O(s) + H_2O(g)$, $\Delta H_{500}° = 30.4 \pm 1.0$ kcal; $2LiOH(s) \rightarrow Li_2(OH_2(g)$, $\Delta H_{600}° = 45.0 \pm 3.0$ kcal. (auth)

21453

THE VAPOUR PRESSURE OF URANIUM TETRAFLUORIDE. S. Langer and F. F. Blankenship (Oak Ridge National Lab., Tenn.). J. Inorg. & Nuclear Chem. 14, 26-31 (1960) July. (In English)

The vapor pressure of liquid UF_4 was measured between 4 and 180 mm Hg (1018 to 1302°C) by a combination of the

quasi-static method of Rodebush and Dixon and a boiling point technique. The data are consistent with the extrapolation of the effusion measurements by Ryon and Twichell on solid UF_4. The vapor pressures of the liquid can be represented by the equation: $\log P_{(mm\ Hg)} = -(16.840 \pm 44)/T - 7.549 \log T + 37.086 \pm 0.03$. Extrapolation of the data to the normal boiling point of 1729°K, with the assumption of a ΔC_p of vaporization of −15 cal/deg mole, gives a heat of vaporization of 51.2 ± 0.2 kcal/mole at the boiling point. The entropy of vaporization at the normal boiling temperature is 29.7 e.u. in reasonable agreement with those of other heavy metal tetrafluorides. The close agreement between the extrapolated effusion measurements (assuming the vapor species to be monomeric) and the measured pressures indicates the absence of associated molecules in the vapor phase. (auth)

21454

X-RAY AND KINETIC STUDY OF THE HYDROGEN REDUCTION OF γ-UO_3. K. J. Notz and M. G. Mendel (National Lead Co. of Ohio, Cincinnati). J. Inorg. & Nuclear Chem. 14, 55-64(1960) July. (In English)

The hydrogen reduction of γ-UO_3 to UO_2 was studied by x-ray examination of quenched samples and kinetic observations over the temperature range 450 to 550°C and hydrogen partial pressures between ¼ and 1 atm. The data were interpreted in terms of three consecutive reactions: $UO_3 \rightarrow U_3O_{8+}$, $U_3O_{8+} \rightarrow U_3O_{8-}$, $U_3O_{8-} \rightarrow UO_2$. In both the first and third steps, two solid phases are present; it is postulated that the second step involves the homogeneous transition between the upper and lower limits of the U_3O_8 structure. The rate of reaction is directly proportional to surface area. Rate data obtained for the first and third steps of the reaction are expressed as a function of temperature and hydrogen partial pressure: Rate (per unit surface) = $KP^n \exp(-E/RT)$. The pressure dependence exponent, n, is approximately 0.8. The activation energy E is 25.2 ± 2.0 kcal/mole for the reaction, $UO_3 \rightarrow U_3O_{8+}$, and 30.6 ± 1.8 kcal/mole for the reaction, $U_3O_{8-} \rightarrow UO_2$. (auth)

21455

THE SOLUBILITIES OF LANTHANUM CHLORIDE 7-HYDRATE AND LANTHANUM CHLORIDE 6-HYDRATE IN WATER, AND A STUDY OF THE THERMAL DECOMPOSITION OF HYDRATED LANTHANUM CHLORIDE. J. E. Powell and H. R. Burkholder (Iowa State Univ., Ames). J. Inorg. & Nuclear Chem. 14, 65-70(1960) July. (In English)

Thermal decomposition of $LaCl_3 \cdot 7H_2O$ results in the stepwise formation of $LaCl_3 \cdot 3H_2O$, $LaCl_3 \cdot H_2O$, $LaCl_3$, and LaOCl. Under proper conditions either $LaCl_3 \cdot 6H_2O$ or $LaCl_3 \cdot 7H_2O$ may separate from aqueous solutions of lanthanum chloride. The solubilities of the 6- and 7-hydrates at various temperatures are given. (auth)

21456

THE KINETICS OF THE REACTION BETWEEN PLUTONIUM(IV) AND VANADIUM(III) IN PERCHLORATE SOLUTION. S. W. Rabideau and R. J. Kline (Los Alamos Scientific Lab., N. Mex.). J. Inorg. & Nuclear Chem. 14, 91-7 (1960) July. (In English)

The kinetics of the reduction of Pu(IV) with V(III) was studied as a function of temperature and acidity in perchlorate solutions of ionic strength 2M. The reaction rate was found to be first order with respect to each of the reactants and inversely proportional both to the first power and to the second power of the hydrogen ion concentration. Thermodynamic quantities for the activation process in terms of the principal species were obtained for the parallel paths at 25°C. It is shown that the rate of the reduction reaction was unaffected by the presence of added chloride ion and it appears that the chloride ion does not function as a bridging group in the activated complex. The entropies of the activated complexes for both hydrogen ion dependent paths were calculated and compared with reactions involving similar charge types. (auth)

21457

HOMOGENEOUS AND HETEROGENEOUS ISOTOPIC EXCHANGE Fe^{2+}/Fe^{3+}. K. H. Lieser and H. Schroeder (Technische Hochschule, Darmstadt, Ger.). J. Inorg. & Nuclear Chem. 14, 98-103(1960) July. (In German)

The homogeneous isotopic exchange in aqueous solution is strongly catalyzed by sulfuric acid. Sulfuric acid exists predominantly in the form of HSO_4^- ions and therefore is able to effect the transfer of hydrogen atoms along hydrogen bonds. The heterogeneous isotopic exchange between Fe^{2+} ions in solution and the solid water-free sulfate of Fe^{3+} is also effected by the mutual change of the oxidation state. The rate determining step is preceded by a dissociation equilibrium of the hydrated Fe^{2+} ions; hydrogen atoms are probably formed, which transfer a negative charge to the Fe^{3+} ions of the solid sulfate. (auth)

21458

THE MELTING AND BOILING POINTS OF BERYLLIUM CHLORIDE AND AN INVESTIGATION OF THE NaCl/$BeCl_2$ SYSTEM. E. Furby and K. L. Wilkinson (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 14, 123-6(1960) July. (In English)

$BeCl_2$ for the m.p. and b.p. determinations was prepared by chlorination of Be oxide and Be and by purification of crude $BeCl_2$. The results were an average m.p. of 399 ± 1°C and an average b.p. of 482.5 ± 1°C; a second halt in the cooling curve in the m.p. determinations was observed and ascribed to a transition to a second crystalline form. The NaCl-$BeCl_2$ system was studied by determining the m.p. of various mixtures, and a phase diagram was constructed from the data and found to be similar to that by Schmidt; however, an eutectic of 210°C at 55 mole % $BeCl_2$ was observed as compared to Schmidt's eutectic of 215°C at 51 mole % $BeCl_2$. (D.L.C.)

21459

EFFECT OF GRAPHITE ON MOLTEN SAMARIUM FLUORIDE AT ELEVATED TEMPERATURES. A. D. Kirshenbaum and J. A. Cahill (Temple Univ., Philadelphia). J. Inorg. & Nuclear Chem. 14, 148-9(1960) July. (In English)

Of the Group IIA and IIIA fluorides in the molten state. only Nd and Sm trifluorides are reduced by graphite. When NdF_3 was heated for 2 hr in a graphite crucible at 1700 to 2200°K, ~1.5% of it was converted into the carbide. SmF_3 (white) was reduced to SmF_2 (red-brown) by heating in a graphite crucible. The effects of temperature, time, and carbon surface area on reduction of SmF_3 to SmF_2 were studied and found to be proportional, giving a maximum reduction of 30 wt.% for 2 to 4 hr heating at 2300°K. W and Mo were found to have little or no reducing action on SmF_3. (D.L.C.)

21460

HEATS OF ADSORPTION AND ADSORPTION ISOTHERMS FOR LOW BOILING GASES ADSORBED ON GRAPHON. E. L. Pace and A. R. Siebert (Western Reserve Univ., Cleveland). J. Phys. Chem. 64, 961-3(1960) Aug.

The results of a calorimetric investigation of the equilibrium pressures and differential heats of adsorption for nitrogen, argon, neon, orthodeuterium, parahydrogen, and helium (He^4) adsorbed on Graphon in the neighborhood of their respective boiling points are presented. (auth)

21461

THE REACTIONS OF WATER VAPOR WITH BERYLLIA AND BERYLLIA–ALUMINA COMPOUNDS. William A. Young (Atomics International, Canoga Park, Calif.). J. Phys. Chem. 64, 1003-6(1960) Aug.

The reactions of water vapor with BeO, $BeO \cdot Al_2O_3$, and $BeO \cdot 3Al_2O_3$ were studied in the range 1300 to 1575°C using a transpiration technique. The equilibrium constants for the reactions per mole of water are given by: $\log K_p = 1.93 - 9280/T$, $\log K_p = 2.45 - 10800/T$, and $\log K_p = 1.55 - 9450/T$, respectively. Values of ΔF^0, ΔH^0, and ΔS^0 are given for these reactions and for solid state reactions involving these materials and alumina. (auth)

21462

ELECTROMOTIVE FORCE MEASUREMENTS IN THE SYSTEM $AgNO_3$–NaCl–$NaNO_3$ AND THEIR COMPARISON WITH THE QUASI-LATTICE THEORY. D. G. Hill, J. Braunstein, and M. Blander (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 64, 1038-41(1960) Aug.

Measurements of the activity coefficients of $AgNO_3$, γ_{AgNO_3}, in dilute solutions of Ag^+ and Cl^- ions in $NaNO_3$ were made at 331, 364, 385, 402, 423, 438, and 500°C. The concentration dependence of $\log \gamma_{AgNO_3}$ is closer to the symmetric approximation based on the quasi-lattice model than to the asymmetric approximation. Average values of the relative energies of ion pair formation, ΔE, as defined in the quasi-lattice model, were calculated by comparison of the symmetric approximation with the experimental results. For Z = 4, 5, and 6 the values of ΔE averaged over all seven temperatures are −5.13, −4.83, and −4.59 kcal/mole, respectively. The values of ΔE were constant at all seven temperatures. The conventional association constant for the formation of the ion pair $A^+ - C^-$, K_1, is equal to $Z[\exp(-\Delta E/RT) - 1]$. The constancy of ΔE at all temperatures studied and for all reasonable values of Z means that from measurements of K_1 at one temperature, one may, in this system, correctly predict K_1 at all other temperatures by use of the lattice model. (auth)

21463

HEATS OF SOLUTION IN LIQUID AMMONIA AT 25° Stuart R. Gunn and LeRoy G. Green (Univ. of California, Livermore). J. Phys. Chem. 64, 1066-9(1960) Aug.

Heats of solution at 25°C of water, methylamine, and several salts in ammonia, and of potassium iodide in methylamine were measured, mostly at mole ratios of 200 to 16,000. Heats of dilution of the salts in ammonia are very large, some ten times the calculated limiting Debye–Hückel slope for 1-1 electrolytes, and are nearly independent of valence type and ionic size. Heats of dilution of nonelectrolytes are not detectable. (auth)

21464

THE EXTREME SENSITIVITY OF PARAMAGNETIC SITES TO POISONING BY DESORBED GASES EVALUATED BY THE LOW TEMPERATURE ORTHO-PARAHYDROGEN CONVERSION. Douglas S. Chapin, C. Dick Park, and Myron L. Corrin (Univ. of Arizona, Tucson). J. Phys. Chem. 64, 1073-4(1960) Aug.

The effect of gaseous impurities from Pyrex glass walls on the ortho-parahydrogen conversion catalyzed by silica gel-supported neodymia at 77°K and means of eliminating this effect were studied. The impurities were found to reduce rate constants by as much as a factor of four, and trapping close to the catalyst surface near 77°K was found to minimize the effect. The impurities appear to have an appreciable vapor pressure at 195°K but none at 77°K; they are tentatively concluded to be CO_2 and H_2O, which are known to be evolved from Pyrex glass on heating. (D.L.C.)

21465

PHASE EQUILIBRIA IN SYSTEMS INVOLVING THE RARE-EARTH OXIDES. PART I. POLYMORPHISM OF THE OXIDES OF THE TRIVALENT RARE-EARTH IONS. R. S. Roth and S. J. Schneider. J. Research Natl. Bur. Standards 64A, 309-16(1960) July-Aug.

The polymorphic relationships of the pure rare-earth oxides were reinvestigated using x-ray diffraction methods for identification of phases. The oxides of the trivalent rare earth ions crystallize in three different types: A, B, and C. Each oxide has only one truly stable polymorph: La_2O_3, Ce_2O_3, Pr_2O_3, and Nd_2O_3 belong to the A type; Sm_2O_3, Eu_2O_3, and Gd_2O_3 to the B type; Tb_2O_3, Dy_2O_3, Ho_2O_3, Er_2O_3, Tm_2O_3, Yb_2O_3, and Lu_2O_3 to the C type. In addition Nd_2O_3, Sm_2O_3, Eu_2O_3, and Gd_2O_3 have low-temperature, apparently metastable, C-type polymorphs. The low-temperature form inverts irreversibly to the stable form at increasingly higher temperatures for decreasing cation radius. (auth)

21466

PHASE EQUILIBRIA IN SYSTEMS INVOLVING THE RARE-EARTH OXIDES. PART II. SOLID STATE REACTIONS IN TRIVALENT RARE-EARTH OXIDE SYSTEMS. S. J. Schneider and R. S. Roth. J. Research Natl. Bur. Standards 64A, 317-32(1960) July-Aug.

Selected mixtures in 21 binary and 9 ternary rare-earth oxide systems were studied by x-ray diffraction after heat treatment at 1650°C and above. Two graphs were drawn to show specific regions of stability for the various structure types. Each gives the average ionic radius of constituent cations versus the mole percent of the smaller cation. One diagram is essentially divided into areas of solid solution of the A, B, and C rare-earth oxide structure types. The other indicates a field of perovskite-type compounds bordered by regions of A, B, or C solid solutions. These diagrams were used to predict the subsolidus phase diagrams of a number of systems. A total of forty-one subsolidus binary and one ternary rare-earth oxide systems were given. A tolerance factor equal to 0.77 was assigned as the minimum value for the formation of a perovskite-type compound. (auth)

21467

ON THE ISOTOPIC EFFECTS IN THE FERROELECTRIC BEHAVIOUR OF CRYSTALS WITH SHORT HYDROGEN BONDS. R. Blinc (J. Stefan Institute, Ljubljana, Yugoslavia). Phys. and Chem. Solids 13, 204-11(1960) June. (In English)

An attempt to correlate the isotopic effects in the ferroelectric properties of hydrogen-bonded crystals with the observed anomalies in their i.r. and n.m.r. spectra led to the conclusion that the protons in the hydrogen bonds are tunnelling in double-minimum potential fields. The ferroelectric transition is assumed to be the result of a deformation of the protonic distribution due to electrostatic interactions. It was found that a quantum-mechanical extension of Mason's and Devonshire's long-range-forces model is able to explain, by the same mechanism, the results of i.r. and n.m.r. spectroscopy as well as the dependence of the Curie point on the mass of the hydrogen isotope, the sharper increase of the spontaneous polarization with falling temperature and the larger value of the spontaneous polarization at absolute zero for deuterated than for hydrogen compounds. The proposed model predicts that a ferroelectric transition occurs only if the dipole–dipole interactions, expressed as frequencies, are greater than the tunnelling frequency on the lowest vibrational level. (auth)

21468

COPRECIPITATION OF Pu(IV) WITH LANTHANUM OXALATE. V. I. Grebenshchikova and R. V. Bryzgalova. Radiokhimiya 2, 265-73(1960). (In Russian)

Plutonium coprecipitation with lanthanum oxalate forms anomalous mixed crystals with a lower miscibility boundary at micro component concentrations from 10^{-6} to 10^{-9} M. The distribution of Pu(IV) between the lanthanum oxalate and the solution follows the Khlopin or logarithmic law, depending on the conditions of coprecipitation. A strong plutonium enrichment of lanthanum oxalate crystals was observed in nitric acid solutions (1.5 and 0.5 M) with oxalic acid or ammonium oxalate not exceeding 0.1 M. An increased oxalate ion concentration reduces the crystallization factor by forming complex Pu(IV) ions with oxalate. Thus, coprecipitation of Pu(IV) with trivalent carrier behaves like the trivalent element and differs only by a diminished crystallization factor. (R.V.J.)

21469

INFRARED SPECTRA OF URANYL NITRATE HYDRATE SOLUTIONS AT WATER DEFORMATION VIBRATION FREQUENCIES. V. M. Vdovenko, D. N. Suglubov, and E. A. Smirnova. Radiokhimiya 2, 297-300(1960). (In Russian)

Studies of spectral variations of uranyl nitrate dihydrate solutions in certain organic diluents and of uranyl nitrate ether solutions with various water concentrations indicated polarization of the coordinated uranium–water, formation of a hydrogen bond between hydrate and diluent molecules, and irregular positions of the first two and of the following water molecules in the coordination sphere. Comparisons of uranyl nitrate spectra in ethyl ether–CCl_4, with various water concentrations, show that the hydration diminishes with increasing CCl_4 content as a result of greater water freedom and a second water solvation layer. The hydrogen bond between the hydrate and ether does not break even at very high concentrations of CCl_4. (R.V.J.)

21470

OXALATE COMPOUND OF NEPTUNIUM(IV) IONS. P. I. Kondratov and A. D. Gel'man. Radiokhimiya 2, 315-19 (1960). (In Russian)

The complexing of Np^{4+} with oxalate was investigated. The solubility product of neptunium oxalate was $Sp_{18°} = (8.6 \pm 1.8) \times 10^{-23}$. The stability concentration was: $[Np(C_2O_4)^{2+}]$, $K_1 = (2.9 \pm 2) \times 10^{-8}$; $[Np(C_2O_4)_2]^0$, $K_2 = (2.9 \pm 0.05) \times 10^{-15}$; $[Np(C_2O_4)_3]^{2-}$, $K_3 = (1.1 \pm 0.1) \times 10^{-24}$; $[Np(C_2O_4)_4]^{4-}$, $K_4 = 4 \times 10^{-28}$. (R.V.J.)

21471

PROPERTIES OF NITRIC ACID SOLUTIONS OF PLUTONYL. III. STABILITY OF PLUTONYL IN NITRIC ACID SOLUTIONS. V. D. Nikol'skii, M. E. Pozharskaya, and B. G. Pozharskii. Radiokhimiya 2, 320-9(1960). (In Russian)

The stability and the mechanism of radiolytic reduction of plutonyl in nitric acid solutions were studied. The radiolytic reduction rate decreases with increased acid concentration and increases with the increase of plutonyl. Pentavalent plutonium forms in the radiolytic reduction of dilute nitric acid solutions (pH 2.15 to 3.55). The reduction of hexavalent plutonium to redox plutonyl compounds follows the reaction scheme $PuO_2OH^+ + H \rightleftharpoons PuO_2^+ + H_2O$. Plutonyl reduction results in increased concentrations of hydrogen ions formed by water radiolysis and hydrogen ionization by plutonium radiation. The accumulation of hydrogen ions produces tetravalent plutonium in the reactions $2PuO_2^+ + 4H^+ \rightleftharpoons PuO_2^{2+} + Pu^{4+} + 2H_2O$. Disproportionation reaction in tetravalent plutonium follows the scheme $3PuOH^{3+} \rightleftharpoons PuO_2^{2+} + 2Pu^{3+} + H^+ + H_2O$ with the participation of $Pu(OH)_2^{2+}$ and possibly $Pu(OH)_3^+$; $Pu(OH)_4$ molecules participate in polymerization reactions. (R.V.J.)

21472

DISPROPORTIONATION OF AMERICIUM(V) IONS. A. A. Zaitsev, V. N. Kosyakov, A. G. Rykov, Yu. P. Sobolev, and G. N. Yakovlev. Radiokhimiya 2, 339-47(1960). (In Russian)

The kinetics of AmO_2^+ disproportionation in perchloric, sulfuric, and nitric acids were investigated, and the rate constants were determined. The dependence of disproportionation on hydrogen ion concentration was determined for perchloric and sulfuric acids. The rates of disproportionation in perchloric acid as functions of temperature and thermodynamics were determined for activated complexes. (R.V.J.)

21473

THE KINETICS OF AMERICIUM(V) REDUCTION BY HYDROGEN PEROXIDE. A. A. Zaitzev, V. N. Kosyakov, A. G. Rykov, Yu. P. Sobolev, and G. N. Yakovlev. Radiokhimiya 2, 348-50(1960). (In Russian)

The kinetics of AmO_2^+ reduction by hydrogen peroxide in 0.1 M perchloric acid were studied, and the temperature dependence of the rate constants was determined. The activation energy and activated complex enthalpy variations are calculated. (R.V.J.)

21474

ON THE COMPLEX FORMATION OF Am^{3+} WITH ION OXALATES. I. A. Lebedev, S. V. Pirozhkov, V. M. Razbitnoi, and G. N. Yakovlev. Radiokhimiya 2, 351-6 (1960). (In Russian)

The formation of Am^{3+} oxalate complexes was studied by solubility methods. Am^{241} with half life 457.7 years was used in the experiment. The formula of americium oxalate at 20 to 90°C is $Am_2(C_2O_4)_3 \cdot 9H_2O$. The solubility of americium oxalate in perchloric acid at 25°C is 2.2×10^{-3}. Analysis of the solubility curve indicated the presence of $Am(C_2O_4)^+$, $Am(C_2O_4)_2^-$, and $Am(C_2O_4)_3^{3-}$ with instability constants 5.0×10^{-8}, 6.9×10^{-5}, and 1.6×10^{-1}. (R.V.J.)

21475

RADIOACTIVE INDICATOR DETERMINATION OF ZIRCONIUM AND PLUTONIUM DOUBLE SULFATES IN SATURATED POTASSIUM SULFATE SOLUTIONS. V. N. Bobrova. Radiokhimiya 2, 364-8(1960). (In Russian)

Zirconium and plutonium double sulfates were prepared by mixing in saturated potassium sulfate solution. The data indicate the absence of plutonium salt hydrolysis. The compositions of the double sulfates of plutonium(IV) and zirconium with potassium bisulfate prepared under identical conditions are different, $K_4Pu(SO_4)_4$ and $K_2Zr(SO_4)_3$. (R.V.J.)

21476

PREPARATION AND PROPERTIES OF HIGH PURITY SCANDIUM METAL. F. H. Spedding, A. H. Daane, G. Wakefield, and D. H. Dennison (Ames Lab., Ames, Iowa). Trans. Met. Soc. AIME 218, 608-11(1960) Aug.

Preparation of pure scandium metal was accomplished by calcium reduction of the fluoride by two methods: a low-temperature alloy process and direct reduction with subsequent distillation of the product. The following properties were determined: melting point, 1181°K; boiling point (calculated), 3000°K; lattice constants at 298°K (hexagonal lattice), a = 3.308 ± 0.001A, c = 5.267 ± 0.003A; calculated

density at 298°K, 2.990 ± 0.007 gm/cm^3; electrical resistivity, 299°K, 66.6 ± 0.2 × 10^{-6} ohm-cm; 373°K, 77.4 ± 0.2 × 10^{-6} ohm-cm, thermal coefficient at 299°K, 5.4 × 10^{-6} ohm-cm per deg; heat of sublimation at 298°K, 80.79 kcal per mole. The vapor pressure was determined as a function of temperature between 1505° and 1748°K and the data fitted to a straight line. (auth)

21477

KNOWLEDGE OF THE Be_3N_2–Si_3N_4 SYSTEMS. THE STRUCTURE OF A NEW MODIFICATION OF Be_3N_2. Peter Eckerlin and Albrecht Rabenau (Allgemeine Deutsche Philips Industrie G.m.b.H., Aachen). Z. anorg. u. allgem. Chem. 304, 218-29(1960) May. (In German)

A new hexagonal modification of Be_3N_2 is formed by heating the known cubic form to temperatures above 1400°C. The transformation is influenced by silicon compounds. The crystal structure of the new modification was determined by single crystal x-ray photographs. The space group is P 6_3/mmc. The dimensions of the unit cell containing 2 formula units are a = 2.841 A and c = 9.693 A. It is proposed to designate the well known cubic anti-Mn_2O_3-structure as α-Be_3N_2 and the hexagonal modification which is formed at high temperatures as β-Be_3N_2. (auth)

21478

STUDIES OF NUCLEAR RESONANCE IN ADSORBED GAS. A. A. Galkin and I. V. Matyash (Inst. of Radiophysics and Electronics, Academy of Sciences, Ukrainian SSR). Zhur. Eksptl', i Teoret. Fiz. 38, 1332-4(1960) Apr. (In Russian)

Nuclear paramagnetic resonance was studied in thin layers of hydrogen, water, and methane in order to determine, by the resonance curve, the interactions between adsorbed gas molecules. The spin echo method was used for measuring the longitudinal and transverse relaxation time T_1 and T_2 (from 10^{-4} to 10 sec) and for evaluating the factors of self-diffusion. (R.V.J.)

21479

DETERMINATION OF INITIAL IONIZATION POTENTIALS OF NEODYMIUM AND PRASEODYMIUM ATOMS. N. I. Ionov and M. A. Mitsev (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl', i Teoret Fiz. 38, 1350-1(1960) Apr. (In Russian)

Correlation experiments were carried out with spectroscopically determined indium with V = 5.79 ev. Atomic beams produced by metallic In, Nd, and Pr evaporated in special evaporators were directed to a heated tungsten filament in order to obtain and measure I_1 and I_2 currents. The temperatures of the filaments were measured by optical pyrometry. The densities of incoming beams were regulated by the magnitudes of ion currents from the filament at T_0 = 2700°K. Graphs of $\lg(I/I_{T_0})$ dependence on 1/T for the surface ionization of In and Pr atoms at 2300 to 2700°K showed that the ratios are well approximated by straight lines. Similar results were obtained for neodymium. Ionization potentials for neodymium and praseodymium atoms, without considering possible ground excitation states, were: V_{Pr} = 5.79 − 0.09 − 0.22 = (5.48 ± 0.01) ev and V_{Nd} = 5.79 − 0.09 − 0.19 = (5.51 ± 0.02) ev. The results confirm theoretical values. (R.V.J.)

21480

APPLICATION OF VACUUM TECHNIQUES TO THE PREPARATION AND PURIFICATION OF CERTAIN FLUORIDES, ESPECIALLY THE TETRAFLUORIDE OF ZIRCONIUM. C. Decroly (Universite Libre, Brussels), J. Gérard, and D. Tytgat. p.526-7 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In French)

A brief description is presented of a method for preparing pure ZrF_4. Emphasis is placed on the advantages of the vacuum technique in purifying the compound. The equipment found necessary to protect the vacuum chamber material against corrosion by certain products is described. (tr-auth)

21481

THE PREPARATION OF PLUTONIUM HALIDES FOR FUSED SALT STUDIES. J. G. Reavis, K. W. R. Johnson, J. A. Leary, A. N. Morgan, A. E. Ogard, and K. A. Walsh (Los Alamos Scientific Lab., N. Mex.). p.89-100 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

Methods are described for the preparation of high-purity trifluoride, tetrafluoride, trichloride, and tribromide of plutonium with essentially quantitative yield on the 100 to 350-g scale. Plutonium(III) fluoride was prepared from plutonium(III) oxalate by reaction with hydrogen fluoride containing hydrogen, while plutonium(IV) fluoride was prepared by hydrofluorination of plutonium peroxide in the presence of oxygen. Plutonium(III) chloride and bromide were formed by the heterogeneous reaction between plutonium hydride and the respective hydrohalogens. (auth)

21482

IMPROVEMENTS IN OR RELATING TO THE PURIFICATION OF SODIUM. David Frederick Altimier and Charles Harold Lemke (to E. I. Du Pont de Nemours and Co.). British Patent 837,268. June 9, 1960.

Sodium having high Ca contents up to 1000 ppm can be purified by mixing it in the molten state with a gas mixture of inert gas-O_2, the O_2 content being less than 2 vol.%, and then settling or filtering. In this way, Ca contents can be reduced to 25 ppm or less. The temperature is below 300°C, and the inert gas can be N_2, Ar, or He. Various methods of effecting intimate contact between the sodium and the gas are given. The form of Ca separated in this manner is found to be mostly elemental Ca, but the presence of O_2 is necessary in the gas to render Ca separable. Application of this method of sodium purification is given on a batch basis. (D.L.C.)

21483

METATHESIS OF PLUTONIUM CARRIER LANTHANUM FLUORIDE PRECIPITATE WITH AN ALKALI. R. B. Duffield (to U. S. Atomic Energy Commission). U. S. Patent 2,931,702. Apr. 6, 1960.

A plutonium fluoride precipitate is converted to plutonium hydroxide by digesting the precipitate with an aqueous alkali metal hydroxide solution.

21484

PREPARATION OF DIBASIC ALUMINUM NITRATE. A. T. Gresky, E. O. Nurmi, D. L. Foster, R. P. Wischow, and J. E. Savolainen (to U. S. Atomic Energy Commission). U. S. Patent 2,931,706. Apr. 5, 1960.

A method is given for the preparation and recovery of basic aluminum nitrates having an OH : Al ratio of at least two, comprising two steps. First, metallic aluminum is dissolved in aqueous $Al(NO_3)_3$, in the presence of a small

quantity of elemental or ionic mercury, to increase its Al : NO_3 ratio into the range 1 to 1.2. The resulting aqueous solution is then added to an excess of a special organic solvent, typically a mixture of five parts methanol and six parts diethyl ether, whereupon the basic aluminum nitrate, e.g. $Al_6(OH)_{13}$-$(NO_3)_5$, recoverably precipitates.

21485

PROCESS OF REDUCING PLUTONIUM TO TETRAVALENT [TRIVALENT] STATE. D. F. Mastick (to U. S. Atomic Energy Commission). U. S. Patent 2,936,213. May 10, 1960.

The reduction of hexavalent and tetravalent plutonium ions to the trivalent state in strong nitric acid can be accomplished with hydrogen peroxide. The trivalent state may be stabilized as a precipitate by including oxalate or fluoride ions in the solution. The acid should be strong to encourage the reduction from the plutonyl to the trivalent state (and discourage the opposed oxidation reaction) and prevent the precipitation of plutonium peroxide, although the latter may be digested by increasing the acid concentration. Although excess hydrogen peroxide will oxidize plutonium to the plutonyl state, complete reduction is insured by gently warming the solution to break down such excess H_2O_2. The particular advantage of hydrogen peroxide as a reductant lies in the precipitation technique, where it introduces no contaminating ions. The process is adaptable to separate plutonium from uranium and impurities by proper adjustment of the sequence of insoluble anion additions and the hydrogen peroxide addition.

Radiation Chemistry and Radiochemistry

21486 AERE-R-3274

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE REMOVAL OF Cs^{137} AND Sr^{90} FROM AQUEOUS SOLUTION BY ION EXCHANGE ON VERMICULITE. D. C. Sammon and R. E. Watts. May 1960. 25p. BIS.

Ion-exchange kinetics and equilibria of caesium, magnesium, sodium, and strontium ions on exfoliated vermiculite were studied with a view to its use in radioactive effluent treatment. The results are discussed in terms of the accepted structure of vermiculite and some comparisons are drawn between the behavior in exfoliated and crude forms. (auth)

21487 FZM-1969

Convair, Fort Worth, Tex.

A COMPUTER TECHNIQUE FOR SPECTRAL ANALYSIS. Don Borgholthaus. June 12, 1960. 19p. (Paper presented at Summer Meeting of American Nuclear Society, Chicago 12-15 June 1960.) 19p.

During a series of fission product field release tests, irradiated fuel elements were melted in an induction furnace, and the effluent was released to an instrumented network. Cross wind profiles of environment contamination at various distances downwind were measured by a variety of collection media. Approximately 2000 samples were collected and analyzed for Zr–Nb^{95}, Cs^{137}, Ru^{103}, I^{131}, and Ce^{141}. With the aid of a 256-channel analyzer and an IBM-704, a simple and accurate method for rapidly stripping the spectra was devised. The computer was used to solve a set of simultaneous equations based on the pulse-height analyzer output. The solution of these equations yielded the desired quantitative analysis of each isotope. (W.D.M.)

21488 HW-65518

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A STUDY OF THE FEASIBILITY FOR THE LARGE SCALE RECOVERY OF IONIUM (THORIUM-230) FROM THE URANIUM ORE MILLING INDUSTRY IN THE UNITED STATES. Charles A. Rohrmann. June 1, 1960. 19p. OTS.

A study of the ore feeds and certain process streams in mills in Colorado, New Mexico, Oregon, South Dakota, Utah, Washington, and Wyoming representative of those utilizing acid digestion and feed liquor clarification was conducted. Ores from ten mills representing over 70% of the U. S. daily ore tonnage involved with clarified acid feed liquor were investigated. The remaining ores which are processed via the alkaline process and by "resin-in-pulp" processes from which ionium may be recoverable but at higher costs were not analyzed. Those ores on which analyses were obtained represent over one-third of the total U. S. daily ore processing tonnage. Most of these ores showed thorium-232 contents of a very few parts per million and should therefore be sources of thorium containing a few percent of ionium. (The processing of the St. Louis residues was to recover thorium containing about 8% ionium.) Mass spectrographic analyses on thorium from feed solutions from two mills showed ionium contents of 5.3 and 5.4%. Based on thorium-232 analyses in the corresponding ores, isotopic enrichment by preferential solubility was indicated by these analyses. Based on the analyses of these ores alone, about 30% of the total U. S. ore milling capacity appears to be a source of thorium compositions containing more than 1% ionium. On this basis with 0.2% uranium in the ores, assuming equilibrium, a 70% recovery of the ionium and a 300 day operating year, over 40 kilograms of ionium may be recovered annually from those mills on which data were obtained in this study. Such quantities of this rare material would support serious consideration of applications. In the free world, at least, the United States is in a unique position as a potential supplier of such large quantities of ionium. (auth)

21489 NAS-NS-3011

National Research Council. Committee on Nuclear Science.

THE RADIOCHEMISTRY OF ZIRCONIUM AND HAFNIUM. Ellis P. Steinberg, Argonne National Lab. Jan. 1960. 56p. OTS.

Its Nuclear Science Series.

An intensive treatment is presented on the chemistry of Zr and Hf. Their solution chemistry is not well known because of colloid formation, hydrolysis, and polymerization. Coprecipitation of tracer Zr and Hf and the complexing ability of various chemicals for Zr are discussed together with several chelating agents. The extractabilities of ethyl ether, hexone, butyl phosphates, and trialkylphosphine oxides for Zr and Hf are given. Zr and Hf may be separated from each other and other metals by ion exchange, and methods for such separations are given. Counting and radiochemical procedures for the determination of Zr and Hf and separation from fission products are given. In particular, methods are given for the isolation of Zr from uranyl nitrate and from the Y^{89}(d,2n) reaction. A bibliography of 52 references is given, and 13 more are given as general reviews of the inorganic and analytical chemistry of Zr and Hf. (D.L.C.)

21490 NYO-2526

Radiation Applications Inc., Long Island City, N. Y.

A STUDY OF THE MECHANISM OF RADIATION INDUCED REACTIONS OF ORGANIC POLYMERS WITH INORGANIC SALTS AND ORGANOMETALLIC COMPOUNDS. Quarterly

Summary Report [for] April 1, 1960 to June 30, 1960. Aug. 11, 1960. 6p. Contract AT(30-1)-2318. OTS.

The rate of radiation-induced grafting of styrene to polyethylene in a diluant composed of methanol and n-octane (0 to 90%) was found to decrease with increasing n-octane content in the diluant. Methanol accelerated the radiation-induced graft polymerization of styrene to polypropylene with the maximum effect occurring at approximately 50% methanol concentration. Methanol accelerated the radiation-induced grafting of methyl acrylate to nylon with the maximum effect occurring at 30% methanol concentration. (For preceding period see NYO-2525.) (C.J.G.)

21491 RRL-43

Mellon Inst. Radiation Research Labs., Pittsburgh. QUARTERLY REPORT [FOR] APRIL 1, 1960—JUNE 30, 1960. Fundamental Research No. 205. July 14, 1960. 15p. Contract AT(30-1)-2310. (NYO-9162). OTS.

Evidence is presented for radical isomerization during radiolysis of neopentane. In the radiolysis of liquid ethane, an EPR absorption spectrum was observed which is completely consistent with the usual structure assumed for the ethyl radical. The photolysis of phosgene was studied in the presence of ethylene at 69°C. Mass spectrometric studies showed that in gases of high electron affinity, certain anion-molecule reactions can occur with cross sections of the order of 100 A^2. (For preceding period see RRL-38.) (C.J.G.)

21492 USNRDL-TR-422

Naval Radiological Defense Lab., San Francisco. CHEMICAL DOSIMETRIC EFFECTS MEASURED IN SOLUTION AND GEL. R. C. Chandler and L. H. Gevantman. May 2, 1960. 21p.

A study of the irradiation of two chemical systems in aqueous solution and in agar gel revealed enhanced decomposition yields in the agar gels. The first system, consisting of agar : I^- : I_2 indicator, exhibited a proportionate rise in I_2 yield with increasing agar concentration up to 0.3% agar, after which no further rise was observed. The enhanced value at this point was approximately 50%. The second system, consisting of agar : trichloroethylene showed a proportionate rise in H^+ yield with increasing agar concentration up to 0.5% agar, where no further rise was observed. The maximum enhanced value achieved was about 200%. In the trichloroethylene system and presence of an acid dye indicator, bromcresol purple, had a depressive effect in solution and an enhanced effect in the gel. An increase in dye concentration in the gel extended the linear response of the system up to doses of 6.5×10^{16} ev/g. (auth)

21493

RADIATION SELF-DECOMPOSITION OF LABELED COMPOUNDS. Bert M. Tolbert (Univ. of Colorado, Boulder). Atomlight, 1-5(1960) Feb.

Radiation self-decomposition of labeled compounds was investigated. G(M) values, the number of molecules of a substance permanently altered or decomposed per 100 ev of ionizing radiation absorbed, were for several classes of organic compounds. Self-radiation changes were found to depend on the specific activity of the sample, the average energy of the radiation and the fraction absorbed by the compound, the half life of the radioactive isotope, the nature of the radiation, the temperature, and the physical state of the compound. Reduction of self-decomposition was brought about by dissolving in a protecting-medium solvent, absorbing on a solid matrix in a very thin or monomolecular layer, converting to a more stable derivative, keeping it cold, or storing in a vacuum. (M.C.G.)

21494

PREPARATION OF URANIUM-X_1 (THORIUM-234). (Laboratory Note). Roland Muxart (Institut du Radium, Arcueil, France). Bull. soc. chim. France No. 5, 803-4(1960) May. (In French)

The preparation of Th^{234} sources for the study of the 92.63 and 29 kev transitions of Pa^{234} is described. The preparation is made in three steps: enrichment of Th^{234} by aqueous extraction from an etherated solution of uranyl nitrate, Th^{234}—U separation by extraction with tributyl phosphate diluted in benzene, and purification of Th^{234} by exchange on anionic Dowex-1 in nitric media. The Th^{234} source is then obtained directly by evaporation of the hydrochloric elution solution on an appropriate support. (J.S.R.)

21495

EXCITATION ENERGY TRANSFER AND SENSIBILIZATION OF CHEMICAL REACTIONS IN THE RADIOLYSIS OF ORGANIC DISULPHIDE SOLUTIONS. V. A. Krongaus and Kh. S. Bagdasaryan (Karpov Inst. of Physics and Chemistry, USSR). Doklady Akad. Nauk S.S.S.R. 132, 1136-9(1960) June 11. (In Russian)

The effects of the chemical nature of an acceptor on the efficiency of energy transmission and on the degree of energy utilization in acceptor dissociation were analyzed. Studies were made of the radiolysis of dilute benzene solutions of organic disulfides and disulfides containing aromatic and aliphatic substitutes. (R.V.J.)

21496

MEASUREMENT OF DIFFUSION COEFFICIENTS BY METHODS OF RADIOACTIVATION ANALYSIS AND ISOTOPE DILUTION. G. Ya. Ryskin (Leningrad Inst. of Physics and Tech.). Fiz. Tverdogo Tela 1, 952-4(1959) June. (In Russian)

The possibility of measuring very small diffusion coefficients by determining the absolute quantity of diffusing material using the methods of radioactivation analysis and isctope dilution is examined. The character of the method is brought out and the possibility of its experimental implementation is discussed. It is estimated that this method makes it possible to measure diffusion coefficients of the order of 10^{-17} cm^2/sec and smaller. (TTT)

21497

RADIATION CHEMISTRY OF POLYDIMETHYLSILOXANE. I. CROSSLINKING AND GAS YIELDS. A. A. Miller (General Electric Co., Schenectady, N. Y.). J. Am. Chem. Soc. 82, 3519-23(1960) July 20.

The electron-irradiation of a linear polydimethylsiloxane oil, $[-Si(CH_3)_2O-]_n$, with a molecular weight of 85,000, was studied in the glass state at −180° and in the fluid state from −40 to +150°. At 25° and a radiation intensity of 13.8×10^6 r/min., the crosslinking yield, derived from gel and gas measurements, is G(c.l.) = 3.0. In the fluid state the crosslink and gas yields are both temperature- and intensity-dependent. The transition from the fluid to the glass state produces some apparent anomalies in the overall radiation chemical effects. (auth)

21498

ATOMIC AND MOLECULAR HYDROGEN YIELDS FROM IRRADIATED ACIDS. Ralph Livingston and A. J. Weinberger (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 33, 499-508(1960) Aug.

The paramagnetic-resonance method was used to measure the yields of atomic hydrogen from many concentrations of aqueous sulfuric, phosphoric, and perchloric acids at

77°K after irradiation with gamma rays. The yields of molecular hydrogen and oxygen were also measured after similarly irradiated acids were warmed and the gases collected. The correspondence between atom and molecule yields is discussed. In sulfuric and phosphoric acids the atom and molecule yields depend upon whether the acid is a glassy or crystalline solid at the time of irradiation. Prolonged irradiation of 0.129-mole fraction sulfuric acid (glassy) gives a saturation concentration of 3.4×10^{18} hydrogen atoms per gram. The corresponding number for 0.125-mole fraction perchloric acid is 2.9×10^{19}. The scavenging effects of nitric acid and hydrogen peroxide on the atomic and molecular hydrogen yields for 0.129-mole fraction sulfuric acid were measured and are discussed. The corresponding effect of nitric acid on the atom yield from perchloric acid is presented. (auth)

21499

ELECTRON SPIN RESONANCES IN IRRADIATED POTASSIUM AZIDE. A. J. Shuskus (Univ. of Connecticut, Storrs), C. G. Young, O. R. Gilliam, and Paul W. Levy. J. Chem. Phys. 33, 622-3(1960) Aug.

Electron spin resonance (ESR) studies of single KN_3 crystals irradiated with u-v or γ radiation are reported. The crystals were exposed to a Hg lamp at room temperature, and then its ESR studied; no resonances were observed. However, measurements at 77°K revealed hyperfine patterns of nine equally spaced lines due to two nonequivalent sites for the radioinduced defect, and their intensities are consistent with an electron interacting with four equivalent nuclei of spin one. This fact and studies of the anisotropy of the ESR spectra suggest a linear N_4^- molecule-ion lying in the 110 plane. Subsequent experiments with 10^6-r Co^{60} γ radiation at room temperature gave similar results. (D.L.C.)

21500

RADIOLYSIS OF LIGHT WATER AND TRITIATED WATER BY γ RAYS IN THE PRESENCE OF METHYL METHACRYALATE. I. DISCUSSION OF THE ELEMENTARY REACTIONS OF THE DISSOCIATION OF EXCITED AND IONIZED WATER. Florence Fiquet-Fayard (Faculté des Sciences, Paris). J. chim. phys. 57, 453-66(1960) June. (In French)

The correlation rules between the electronic states are generalized to permit the interpretation of the results of mass spectroscopy. The possibility for a given electron transition to lead concurrently to different dissociated states is discussed. An interpretation of the radiolysis in the gaseous phase is presented based on the analysis of different primary processes which can lead to radicals and on the evaluation of their respective frequencies. $G_H = 11.1$ or 7.6 is predicted according to $H_3O^+ + e \rightarrow 2\,H + OH$ or $H + H_2O$. (tr-auth)

21501

RADIOLYSIS OF LIGHT WATER AND TRITIATED WATER BY γ RAYS IN THE PRESENCE OF METHYL METHACRYLATE. II. ISOTOPIC EFFECT IN THE FORMATION OF H AND T RADICALS BY RADIOLYSIS OF TRITIATED LIQUID WATER. Florence Fiquet-Fayard (Faculté des Sciences, Paris). J. chim. phys. 57, 467-78(1960) June. (In French).

The enrichment factor of primary H radicals in light hydrogen is 4.5. This result is compared with the results obtained by previous workers in the case of HDO. It is shown that the experimental results can not be explained uniquely by an effect $HDO^* \rightarrow H + OD$ rather than $D + OH$. It is necessary for several secondary reactions to intervene. A scheme where the radicals are produced from H_3O^+ by proton transfer with the ambient water is proposed. (tr-auth)

21502

THE VALENCY OF ^{208}Tl FORMED BY ALPHA-DECAY IN AQUEOUS SOLUTION. A. H. W. Aten, Jr., I. Heertje, and P. Polak (Inst. for Nuclear Research, Amsterdam). J. Inorg. & Nuclear Chem. 14, 132-3(1960) July. (In English)

The possibility of oxidation by the recoil energy of α decay was investigated by studying the form of Tl^{208} in the α decay products of Bi^{212} in solution. Tl^+ is isoelectronic with Bi^{3+} which is probably the major species of Bi present in solution, and hence Tl^{3+} would form from the loss of two electrons from the decay product of Bi^{212}. The solution was prepared from the radioactive deposit of a radiothorium preparation, Tl^+ and Tl^{3+} added, and the radioactivity collected by each species was measured with two methods, one by extraction of Tl^{3+} and the other by precipitation of Tl^+ as TlBr and Tl^{3+} as $Tl(OH)_3$. It was found that about $\frac{1}{3}$ of the radioactivity was collected in the Tl^{3+} fraction, although the exact proportion depended somewhat on the initial Tl^+ and Tl^{3+} concentrations. (D.L.C.)

21503

FORMATION OF CHLOROACETATE AND BROMOACETATE IONS BY RECOIL PROCESSES IN SOLIDS. M. Vlatkovic and A. H. W. Aten, Jr. (Inst. for Nuclear Physics Research, Amsterdam). J. Inorg. & Nuclear Chem. 14, 134-5(1960) July. (In English)

A series of experiments was conducted to study the path taken by radiohalogen produced by (n,α) and (n,γ) reactions in acetates and halogenacetates. CH_3COOK and CH_3COORb were irradiated with fast neutrons for the reactions $K(n,\alpha)Cl$ and $Rb(n,\alpha)Br$; $CH_2ClCOONa$ and $CH_2BrCOONa$ were irradiated with paraffin-moderated neutrons for the (n,γ) reactions of Cl and Br; and $CH_2BrCOOH$ was irradiated with slow neutrons for the reaction $Br(n,\gamma)Br$. Halide carrier and $AgNO_3$ were added after irradiation, and counts of the radiohalogen present as halide were made on the precipitates. In the case of $CH_2BrCOONa$ and $CH_2BrCOOH$, radiobromine in the form of CH_2Br_2 was also studied. It was found that, with the exception of $CH_2BrCOOH$, the major part of the radiohalogen was in the form of halide, in agreement with Libby's billiard ball theory, which predicts that the radiohalogen atom will be stopped by the heavy cation rather than be stopped next to a CH_2 group. In the case of $CH_2BrCOOH$, 50 to 55% of the radiobromine was found as bromoacetate and ~20% as CH_2Br_2, probably because there is no heavy cation to compete with the bromine in stopping the radiobromine atom. (D.L.C.)

21504

THE PROCESSING OF IRON CYCLOTRON TARGETS IN CONNEXION WITH THE MÖSSBAUER EFFECT IN ^{57}Fe. G. A. Chackett, K. F. Chackett, and B. Singh (Univ. of Birmingham, Eng.). J. Inorg. & Nuclear Chem. 14, 138-9 (1960) July. (In English)

Sources for studies of the Mössbauer effect in the Fe^{57} 14-kev transition were prepared in the following way: Iron cyclotron targets were bombarded with deuterons and processed by solvent extraction and ion exchange to remove Mn^{54} formed by the Fe^{56} (d,α) reaction and the residual Fe; recovery of Co^{57} was over 90%. A solution of nearly pure Fe^{56} was added to the Co^{57} solution, and the resulting solution evaporated to dryness. The solid was compacted into one end of a Si tube and melted into a spherical bead with 0.3% Si impurity. The bead was rolled between Ni sheets to a 0.002-in. thickness for Mössbauer effect studies. Such sources were found to have a proportion of recoilless radiation, i.e., the narrow Mössbauer line, greater than that from Pound and Rebka's data by a factor of 2; this difference is ascribed to the more uniform Co^{57} atom distribution in the iron lattice and to the negligible

line self absorption in a source with small Fe^{57} concentration. (D.L.C.)

21505

RADIOLYSIS OF LIQUID CYCLOHEXANE. T. D. Nevitt and L. P. Remsberg (Standard Oil Co., Whiting, Ind.). J. Phys. Chem. 64, 969-71(1960) Aug.

Radiolysis of liquid cyclohexane results in the formation of three major products (hydrogen, cyclohexene, and dicyclohexyl) in amounts that vary with the total radiation adsorbed. Examination of the reactions with three free-radical scavengers (butyl disulfide, butyl mercaptan, and cyclohexene) demonstrates the formation of thermal hydrogen radicals and shows that hydrogen–radical reactions account for about 40% of hydrogen production. Radiolysis of $C_6H_{12}-C_6D_{12}$ mixtures gave an upper limit of about 25% for direct detachment of hydrogen. The remaining 35 to 60% of the hydrogen must form by other non-radical processes. (auth)

21506

RADIOLYSIS OF CHLOROFORM AND CARBON TETRACHLORIDE. T. H. Chen, K. Y. Wong, and F. J. Johnston (Univ. of Louisville, Ky.). J. Phys. Chem. 64, 1023-5(1960) Aug.

Irradiation of pure degassed $CHCl_3$ with cobalt-60 gammas results in the formation of HCl with $G_{(HCl)} = 11.4 \pm 0.4$. C_2Cl_6 and a liquid which boiled at approximately 165°C also are produced. No H_2 or Cl_2 was observed and these must be formed with efficiencies of $G_{(H_2)} < 0.003$ and $G_{(Cl_2)} < 0.002$. The irradiation of pure degassed CCl_4 results in the formation of Cl_2 with $G_{(Cl_2)} = 0.66 \pm 0.4$. A solid which is essentially pure C_2Cl_6 is the only other observed product. No Cl_2 is produced in mixtures of $CHCl_3$ and CCl_4 in which N_{CHCl_3} is greater than $\cong 0.008$ at a dose of 1.06×10^{21} ev per gram of mixture. HCl yields from CCl_4-CHCl_3 mixtures indicate that an important part is played by energy transfer in this system. (auth)

21507

THE EFFECT OF OXYGEN ON THE RADIOLYSIS OF SILICONES. L. E. St. Pierre and H. A. Dewhurst (General Electric Research Lab., Schenectady, N. Y.). J. Phys. Chem. 64, 1060-2(1960) Aug.

The effect of high pressures of oxygen on the radiolysis of hexamethyldisiloxane was studied. Hexamethyldisiloxane was held under an oxygen pressure of ten atmospheres and irradiated with 800 kvp electrons from a resonance transformer unit. Qualitative and quantitative analyses were carried out chemically, by gas chromatography, and by infrared spectroscopy. The over-all effect of oxygen at 10 atmospheres was the diminution of the vacuum irradiation products and the formation of three major oxygenated products. A marked increase in the total product yield, relative to the vacuum irradiation, was observed with the oxygenated products accounting for approximately 70% of the total yield. The oxygenated products were concluded to be a carboxylic acid $(CH_3)_3Si-O-Si(CH_3)_2CO_2H$ and two Si–OOC– peroxides, namely $(CH_3)_3Si-O-Si(CH_3)_2CH_2-OO-Si(CH_3)_3$ and $(CH_3)_3Si-O-Si(CH_3)_2OOCH_3$. The chemistry of these products is discussed from the point of view of their effect on polymer crosslinking reactions. (auth)

21508

RADIATION CHEMISTRY OF HEXAMETHYLDISILOXANE, A POLYDIMETHYLSILOXANE MODEL. H. A. Dewhurst and L. E. St. Pierre (General Electric Research Lab., Schenectady, N. Y.). J. Phys. Chem. 64, 1063-5(1960) Aug.

A detailed analysis was made of the products from the 800-kvp electron radiolysis of hexamethyldisiloxane. The yields of volatile products were established as $G(H_2) = 0.7$, $G(CH_4) = 1.4$ and $G(C_2H_6) = 0.4$. These yields were decreased by only 50% in the presence of high iodine concentrations indicating a significant contribution by molecular-like processes. The nonvolatile liquid products were examined by gas chromatography and classified into low molecular weight, intermediate molecular weight, and dimer with the yields, 0.5, 1.8, and 1.8 molecules/100 ev, respectively. The results are discussed in terms of free radical and molecular-like reactions and their pertinence to radiation effects in polydimethylsiloxanes indicated. (auth)

21509

CHEMICAL EFFECTS OF THE (n,γ) ACTIVATION OF BROMINE IN THE ALKYL BROMIDES. ISOMERIZATION IN THE BROMOBUTANES. W. H. McFadden, R. G. McIntosh, and W. E. Harris (Atomic Energy of Canada, Ltd., Chalk River, Ont.). J. Phys. Chem. 64, 1076-8(1960) Aug.

The four isomeric bromobutanes were irradiated with low neutron fluxes (total dose < 200 r) in order to study carbon chain isomerization. All four isomers were found to undergo fragmentation to bromomethane, bromoethane, and bromopropanes to the extent of 4.5 to 6% of the radiobromine products. They also yield 10 to 20% high-boiling organic bromides, mostly dibromobutanes. For three of the isomers, the organic retention of radiobromine is in the expected range of 30 to 40%; $(CH_3)_3CBr$ gave nearly 100% organic retention. Carbon chain isomerization was present for all isomers, but it was highest for $(CH_3)_3CBr$, 13.6% as 2-bromobutane. The unusual product proportions of $(CH_3)_3CBr$ are explained by the formation of $(CH_3)_3C$ cations or radicals; this explanation is supported by the fact that the $(CH_3)_3CBr$ ratio of radioactive 2-bromobutane to 2-bromo-2-methylpropane, 0.2, is close to the 0.23 ratio observed for the equilibration of n-butane with 2-methylpropane in the presence of $AlBr_3$ at 25°C. (D.L.C.)

21510

RADIOLYSIS OF FERROUS ION SOLUTIONS IN HEAVY WATER WITH ALPHA PARTICLES AND GAMMA RADIATION. Conrad N. Trumbore (Univ. of Rochester, N. Y.). J. Phys. Chem. 64, 1087-8(1960) Aug.

Radiolysis of $FeSO_4$ in 50 and 99% D_2O solutions was carried out with cobalt-60 γ radiation and 3.4-Mev α particles. The irradiated solutions were 1 mM $FeSO_4$, 1 mM NaCl, and 0.4 M H_2SO_4, and the $Fe_2(SO_4)_3$ complex was measured spectrophotometrically at 3020 A. The results are: (1) Gamma radiation. $G(Fe^{3+})$ were found to be 17 ± 0.3 and 16.1 ± 0.2 for 99 and 50% D_2O solutions, respectively, based on a value of 15.6 for H_2O solutions. (2) Alpha particles. $G(Fe^{3+})$ for 99% D_2O solutions were found to be 5.3 and 3.9 for air-saturated and air-free solutions, respectively. These data together with the values for H_2O solutions (4.7 and 3.4, respectively) give a $G(H)/G(D) = 0.93$, in agreement with that for radical production by γ and x radiations. (D.L.C.)

21511

ELECTRON SPIN RESONANCE STUDIES OF FREE RADICAL DECAY IN GAMMA-IRRADIATED POLYETHYLENE. Billy R. Loy (Dow Chemical Co., Midland, Mich.). J. Polymer Sci. 44, 341-7(1960) June.

Polyethylene was irradiated in vacuo at liquid nitrogen temperature and allowed to warm. The concentration of free radicals, as observed by electron spin resonance (ESR) spectroscopy, decays very quickly to a relatively stable value which is temperature dependent. This behavior is interpreted to mean that these reactive radicals

are relatively close to one another as opposed to random distribution. The cold-irradiated sample was exposed to air, and the formation of the peroxy radical was observed at −80°C. Only 40 to 50% of the radicals reacted. This was interpreted to mean that 90 to 95% of the radicals trapped at −195°C are in the amorphous phase. (auth)

21512

GAMMA IRRADIATION OF HEXAFLUOROBENZENE. R. E. Florin, L. A. Wall, and D. W. Brown (Wright Air Development Center, Wright-Patterson AFB, Ohio). J. Research Natl. Bur. Standards 64A, 269-80(1960) July-Aug.

Mixtures of hexafluorobenzene and benzene were irradiated in liquid phase by means of a Co^{60} gamma source at 20 and 218°C. Perfluoroheptane and various binary mixtures involving perfluoroheptane, hexafluorobenzene, benzene, and cyclohexane were also irradiated at 20°C. Hexafluorobenzene resembled benzene very closely in its behavior upon radiolysis. Generally the fluorocarbon-hydrocarbon mixtures evolved much more SiF_4 (indicating the formation of HF, which reacts with the glass vessel) than the pure fluorocarbon components. The polymer from hexafluorobenzene-benzene mixtures was probably rich in cyclohexadiene and cyclohexene units, resembling that from pure benzene, and its composition ratio exhibited a strong "alternating" tendency. The results are discussed in terms of free-radical and excited-state mechanisms. At 218°C hexafluorobenzene and its mixtures with benzene showed qualitative differences from their behavior at 20°C, although the G values for SiF_4 and polymer remained moderate. (auth)

21513

EFFECTS OF LINEAR ENERGY TRANSFER ON THE RADIOLYSIS OF WATER AND HEAVY WATER. E. Collinson, F. S. Dainton, and J. Kroh (Univ. of Leeds, Eng.). Nature 187, 475-7(1960) Aug. 6.

In order to investigate the effect of the changing linear energy transfer along an alpha particle track in the radiolysis of water, aqueous solutions of 0.1N H_2SO_4 containing either ferrous, ceric, or ceric and thallous ions were irradiated by a flat external alpha source. $G(Fe^{+3})$ and $G(Ce^{+3})$ were plotted against the length of an α track in the solution. For comparison, the linear energy transfer was also plotted for various distances from the end of the track. Beta irradiation of the solutions was also studied. When D_2O was used an isotopic effect was observed which first increased with increasing mean linear energy transfer, then passed through a maximum, and decreased in the region of mean linear energy transfer corresponding to low energy α particles. (M.C.G.)

21514

IRRADIATION MECHANISM IN POLYVINYL CHLORIDE. Constant Wippler (Research Labs. of Saint-Gobain, Antony, France). Nucleonics 18, No. 8, 68-72(1960) Aug.

Experiments on polyvinyl chloride (PVC) solutions are particularly interesting in that they permit studies of radiation effects as functions of intermolecular distances. Measurements are made of average molecular weight, intrinsic viscosity, and solubility as functions of dose and PVC concentration. Interpretations of the curves show that links can form within a molecule, making it smaller, or between molecules, making them larger. Presentations are given of the investigations of PVC in cyclohexanone (CH) and tetrahydrofurane (THF). Intramolecular as well as intermolecular linking was observed in THF, while the linking was strongly inhibited in CH. (B.O.G.)

21515

SELF-DESTRUCTION IN RADIOACTIVE COMPOUNDS. Bert M. Tolbert (Univ. of Colorado, Boulder). Nucleonics 18, No. 8, 74-5(1960) Aug.

In the use of labeled organic compounds a frequent problem is decomposition induced by radiation from the labeling radionuclide. The amount of decomposition is a function of specific activity, radiation sensitivity, and the type radioactivity. Tables are included from which an estimate may be made on how much decomposition has occurred. Methods are described which may be used for the reduction of self-decomposition in the labeled organic compounds. (B.O.G.)

21516

EFFICIENT TRITIUM LABELING WITH AN ELECTRIC DISCHARGE. Frank L. Jackson, George W. Kittinger, and Frank P. Krause (Procter and Gamble Co., Cincinnati). Nucleonics 18, No. 8, 102-5(1960) Aug.

A method is described in which the rate of tritium labeling of organic compounds was increased by means of an electric discharge. Such tagging often takes only a few minutes although without the discharge it would take several days. The labeling procedure is followed by removal of labile tritium with a polar solvent. Subsequent purification involves multiple crystallizations, preferably from several solvent systems. A description is given for the purification procedures as well as procedures for determining the purity of the labeled compounds. (B.O.G.)

21517

THE ACTION OF γ-RAYS ON SODIUM DEOXYRIBONUCLEATE IN SOLUTION. II. DEGRADATION. A. R. Peacocke and B. N. Preston (Univ. of Birmingham, Eng.). Proc. Roy. Soc. (London) 153B, 90-102(1960) Aug. 16.

Changes in the molecular weight and shape of herring sperm sodium desoxyribonucleate (DNA) which were effected by γ irradiation in aqueous solution without exclusion of oxygen were followed by means of the light scattering method. The molecular weights (M_L) were proportional to the first power of the intrinsic viscosities of the irradiated solutions, and this confirmed the basis of previous deductions of the mechanism of degradation (Cox, Overend, Peacocke & Wilson 1955, 1958). This relation agrees with the model of a stiff, highly extended, coiled configuration for DNA in solution, which was also indicated by the proportionality of the radius of gyration of the degraded DNA to the square root of the molecular weight. The probability (p) of occurrence of a fragmentation of the molecule as represented by M_L^{-1}, was a linear function of the square of the radiation dosage (R) over the dosage range of the experiments ($\geq$1.6 ev/P atom). From this it was deduced (i) that $p \propto R^2$, which confirmed the need for two independent, single breaks in the two chains of DNA to produce a double, fragmenting break, and (ii) that the molecular weight distribution was the same at all R, including R = 0, and this implies that the initial molecular weight distribution of the unirradiated DNA was also random. Heating of the irradiated samples caused a further reduction in M_L which was greater the larger the previous radiation dosage, but this reduction was much smaller than would have been expected in the absence of any entanglement between the two disordered chains of the DNA. An attempt is made to estimate the extent to which there is a contribution to the process of degradation from single breaks which are not at opposite positions in the two polynucleotide chains. (auth)

21518

THE ACTION OF γ-RAYS ON SODIUM DEOXYRIBONU-

CLEATE IN SOLUTION. III. DENATURATION. A. R. Peacocke and B. N. Preston (Univ. of Birmingham, Eng.). Proc. Roy. Soc. (London) 153B, 103-10(1960) Aug. 16.

The displacement of the titration curves at 25°C of herring sperm sodium desoxyribonucleate (DNA) irradiated in solution by γ rays was confirmed. Values for the mean extent of denaturation deduced from such curves agree with those obtained from the reversible titration curves that DNA exhibits at -0.7°C. One effect of γ irradiation was to displace these reversible curves asymmetrically in a manner which suggested that the hydrogen bonds linking adenine and thymine were more susceptible to rupture by γ irradiation than were those which link cytosine and guanine. The logarithm of the fraction of titratable groups in helical regions of the DNA was a decreasing linear function of radiation dosage and the significance of this observation is discussed. In the first stages of irradiation, the rupture of cross-linking hydrogen bonds is very efficient and has a G value of thirty-eight base-pairs severed per 100 ev. (auth)

21519

REACTION OF ORGANIC LOW MOLECULAR COMPOUNDS BY COBALT-60 GAMMA RADIATION. I. POLYMERIZATION OF STYRENE. Motome Hamashima. Repts. Gov. Chem. Ind. Research Inst. Tokyo 55, 129-40(1960) Apr. (In Japanese)

The irradiations were performed with a 300-c Co^{60} source. Polymerization of styrene was studied in vacuo by gamma radiation at temperatures of 9 to 30°C. The molecular weight of the polymer depends largely on the reaction temperature and it becomes larger when the temperature increases. The number of styrene molecules disappearing per 100 ev energy absorption at 29 ± 1°C was 470. The over-all heat of polymerization was 5.1 kcal/mole at 28 ± 2°C. About 70 kinds of additives were tested. At the polymerization of styrene with an additive of a tenth mole/l to monomer, its effect was great even in the low concentration. The value of acceleration efficiency, R_E, (= $R_P \times R_M$, R_P is the ratio of polymerization rate and R_M is that of the viscosity average molecular weight of polymer with an additive and without it), is a constant in the additives which have analogous chemical groups or atoms and is independent of the change of reaction temperature. The series of R_E values are: Halogenated compounds > Hydroxy compounds ≥ Acids and their anhydrides > Ketones > Ethers > Esters ≥ Hydrocarbons. (auth)

21520

NEW DATA ON PROTACTINIUM CHEMISTRY. V. A. Mikhailov (Inst. Inorganic Chemistry, Siberian Branch, Academy of Sciences, USSR). Uspekhi Khim. 29, 882-98 (1960). (In Russian)

Data on the chemistry of protactinium published during 1957-1958 are reviewed and evaluated. Separation of protactinium from natural sources, methods of preparation and determination of Pa^{231}, extraction by organic diluent, and ion exchange, absorption, and coprecipitation are discussed. Protactinium in aqueous solutions and the relationship of protactinium to the actinide family are analyzed. 97 references. (R.V.J.)

21521

ALTERATIONS OF ORGANIC CRYSTALS UNDER BOMBARDMENT OF 60 kv ELECTRONS IN THE ELECTRON MICROSCOPE. Ludwig Reimer (Universität, Münster, Ger.). Z. Naturforsch. 15a, 405-11(1960) May-June. (In German)

In vapor-deposited layers of organic materials the decomposition of the crystalline structure in irradiation with 60-kv electrons results at such low irradiation intensities that heating of the layers does not occur. The electron microscopic dark field image from interference schlieren, the decrease of the scattering contrast with the irradiation dose, and the electron diffraction was investigated in paraffin layers. In other layers (stearic acid, glycocol, leucin, anthracene, indigo, and phthalocyanine) the decrease of the intensity of the Debye-Scherrer lines with increasing irradiation doses was followed with electron diffraction. Under the irradiation conditions occurring in practical work all substances have lost their crystalline structure in a short time. Remarkable variations in the critical irradiation dose in aliphatic and aromatic compounds were obtained. Whereas, for instance, glycocol exhibits an amorphous diffraction diagram after an irradiation dose of 10^{-3} amp-sec/cm^2, Cu phthalocyanine needs 3 amp-sec/cm^2. (tr-auth)

21522

A Co^{60} IRRADIATION UNIT FOR LABORATORY USE. J. Valyi-Nagy (Central Research Inst. for Physics, Budapest). p.121-6 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

A description is given of an irradiation unit designed to contain a maximum of 500 curies of Co^{60}. Details of the construction and operation are given and the unit is compared with the performance of some similar units in other institutes. (auth)

21523

USE OF MICROPOROUS NUCLEAR FUELS AS A MEANS OF UTILIZING THE KINETIC ENERGY OF FISSION PRODUCTS IN CHEMICAL SYNTHESIS. R. Coekelbergs, P. Gosselain, J. Juliens, L. Schotsmans, and M. van der Venne (Ecole Royale Militaire, Centre des Sciences Nucleaires, Brussels). p.191-221 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In French)

Possible uses of the kinetic energy of fission products are discussed in the case of gaseous phase weak G reactions. The problem is mainly one of the amount of energy available; industrial production would require ionizing radiation energies of several tens of megawatts. A body of supplementary data obtained with microporous nuclear fuels is given; they refer to decomposition of N_2O, methane radiolysis, and fixation of nitrogen in the form of oxides. The results of the experiments are described with reference to the following parameters: radiation dose, type of radiation, type and dimensions of the microporous support surface. This work confirms the existence of a phenomenon called "heterogeneous radiocatalysis" and enables its nature to be better defined. The nitrogen fixation reaction carried out with these fuels has some interesting features. In some cases, the rate of formation of the nitrogen oxides varies little for oxygen burnup rates ranging up to 50%. The apparent G, calculated with reference to the total fission energy dissipated in the "solid/reactive gas" system varies, according to case, from 0.1 to 0.4. The temperature is 80°C and the pressure approximately 25 atmospheres. A thorough study of the microstructure of the solids used was begun, and the spectrum of the pores was measured. A rough theoretical sketch of the phenomenon of "heterogenous radiocatalysis" is tentatively put forward. A discussion is given of how such microporous fuels could be used in the building of "chemonuclear" reactors. A brief study of some possible solutions shows what difficulties are still to be overcome. (auth)

21524

PRESENT STATUS OF NITROGEN FIXATION BY REACTOR RADIATION. P. Harteck and S. Dondes (Rensselaer Polytechnic Inst., Troy, N. Y.). p.231-54 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Investigations in nitrogen fixation by reactor radiation carried out at Rensselaer and Brookhaven National Laboratory for a number of years used the fission recoil energy directly as ionizing radiation by means of the dispersion of U^{235} in glass fibers about five microns in diameter. The effects of temperature, pressure, and nitrogen-oxygen ratio on the G value for nitrogen fixation were determined and reported in the literature. A brief summary of this work is given. The above work was done in static systems; more recent work involved both static and flow systems. In static systems, major emphasis was placed on the effect of radiation intensity especially at the kinetic radiation equilibrium. It was found that the production of NO_2 and N_2O in 4 : 1 and 2 : 1 nitrogen-oxygen mixtures proceeds to the point of total oxygen consumption. A flow (cycling) system is now operating in a loop in the Brookhaven reactor. Data are presented on the effects of temperature, pressure, mixture ratio, and radiation intensity which may be applied to the design of a future chemonuclear reactor. The present system is operating at 10 atmospheres and 150°C. The temperature is a function of the fission energy released in the glass fibers and the heat resistance of the loop. Another loop to operate at 50-75 atmospheres and 600°C is under construction. These loops make possible the evaluation of the characteristics of a continuous system, including the behavior of the fission products released in the gas stream. The complicated kinetics of nitrogen oxidation are outlined in three stages: initial reactions in the systems, reactions after some fixed nitrogen has been produced, and finally the kinetics at radiation equilibrium. The conditions for the formation of N_2O_3, N_2O_4, and O_3 are considered, together with their effects on the overall process. (auth)

21525

PHYSICAL PROPERTIES OF P.V.C. ATTENUATED NETWORK COPOLYMERS PRODUCED BY IONIZING RADIATION. S. H. Pinner (Tube Investments Research Labs., Cambridge, Eng.). p.273-89 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The crosslinking of polyvinyl chloride (PVC) with ionizing radiation poses special problems. Due to rather unfavorable crosslinking and dislinking parameters for this polymer, the radiation doses necessary for high crosslink densities are uneconomically large and discoloration and dehydrohalogenation are simultaneously produced. These difficulties were overcome by the incorporation into the PVC, prior to irradiation, of diallyl and triallyl esters. Heavily crosslinked products are thereby obtained with relatively low doses of ionizing radiation. Examination of the physical properties of the products suggests that these are not simply graft copolymers, but are polymer attenuated allyl networks. In these materials, the desirable properties of the parent polymer and of the allyl network are combined. The tensile strength, modulus, and elongation of the attenuated network copolymers are presented and discussed as a function of temperature and of the concentration and functionality of the allyl ester. Reference is also made to the swelling and chemical resistance of the products. (auth)

21526

ELECTRON SPIN RESONANCE STUDIES IN THE RADIATION CHEMISTRY OF HIGH POLYMERS. S. Ohnishi, M. Kashiwagi, Y. Ikeda, and I. Mitta. p.291-320 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The electron spin resonance spectra of a number of gamma-irradiated polymers were measured. Identification proved difficult in many cases because of complications due to the following reasons. (1) A superposition of several kinds of radicals. (2) The spectra of radicals produced in different states of aggregation of the polymers are not the same. (3) The spectra are affected by dose rate as well as total dose. An investigation was made of the ESR spectra obtained by polymers in different states of aggregation. For some polymers, such as nylon, polyethylene, and polyvinyl alcohol, the spectra of the stretched and unstretched samples are different. Differences are also found when the polymers are heat treated. In the case of terylene no difference was observed by stretching or heat treatment. A kinetic study was made of the rate of radical formation and decay and from the results G values were calculated for radical formation. The effect of temperature on the decay process was studied and activation energies for decay were found. Conditions for the successful trapping of different types of radicals and the effect of oxygen on radicals formed by irradiation was also followed. An interpretation of the process of radical decay in the presence of oxygen was made in terms of standard oxidation kinetics. (auth)

21527

TECHNIQUES FOR THE IMPROVEMENT OF PLASTICS BY ULTRA-VIOLET LIGHT. G. Oster. p.321-9 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The use of ultraviolet light for crosslinking and surface grafting of polymers is described. It is pointed out that the energy emission from a small ultraviolet lamp is at least as great as that from a large accelerating machine and that therefore the cost of irradiation using ultraviolet light should be quite low. The polymers are sensitized by the addition of certain carbonyl compounds such as benzophenone. It is found that the crosslinking of polyethylene in the presence of sensitizers gives a material having greatly improved tensile strength at elevated temperatures. Surface grafting of polyethylene with acrylamide was also carried out. The advantages of the technique lie in cost, speed, and safety although lack of penetration may limit its use to thin films. (auth)

21528

EFFECTS OF RADIATION ON POLYVINYL ALCOHOL. M. Matsumoto and A. Danno. p.331-9 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The change in the viscosity of polyvinyl alcohol solutions on irradiation was investigated. An initial decrease is followed by an increase as gelation sets in. Solutions of polyvinyl alcohol in aqueous dimethyl sulfoxide were irradiated, but no crosslinking took place. A viscosity increase was observed in solutions containing less than 5% of dimethyl sulfoxide, but at concentrations greater than this the dimethyl sulfoxide acts as a scavenger. The chemical changes taking place when polyvinyl alcohol was irradiated were studied. The carbonyl group content was determined by reaction with paranitrophenyl hydrazine.

The rate of formation of carbonyl groups was independent of the dose rate. The chemical structure of irradiated polyvinyl alcohol was investigated and it was found that the crosslinks produced on irradiation were sensitive to sodium periodate solutions. This is known to decompose the 1,2 glycol, α-oxiketone and the α-diketone bonds. The results suggest that the crosslinks may have the structure of one of these three types of linkage. (auth)

21529

CROSS-LINKING OF P.V.A. BY GAMMA RADIATION. H. Dieu and V. Desreux. p.341-6 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In French)

The action of gamma rays on aqueous solutions of polyvinyl alcohol was observed by determination of the viscosity, sedimentation constant, and acetylation rate. There was a very definite critical concentration, 0.28%, below which a B gel could not be formed by any dose. Above the critical concentration, the chief reaction was apparently intermolecular crosslinking which increased with dosage. Below the critical concentration the reactions were much more complex. At small doses there was probably some competition between inter- and intra-molecular crosslinking and the formation of more symmetrical molecular clusters. At higher doses the aggregates and the molecular clusters were subject to more and more internal and external crosslinking, leading finally to the formation of micro-gel particles. At decreasing concentrations (0.2 to 0.6%) intramolecular crosslinking apparently became increasingly important. The effects of radiation are thought to depend upon the initial concentration of the polyvinyl alcohol solutions. (auth)

21530

THE USE OF IONIZING RADIATION IN THE VULCANIZATION OF SILICON RUBBER. A. S. Kuz'minskiĭ, T. S. Nikitina, L. A. Oksent'evich (Rubber Research Inst., Moscow). p.347-58 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In Russian)

A detailed study was made of the properties of materials obtained by irradiating mixtures of polydimethylsiloxane rubber and various filiers (special silicic acid, titanium dioxide, flue dust, chimney soot, and lamp black). The irradiation was done with a powerful x-ray unit and a Co^{60} gamma ray source of 20,000 g radium equivalent. The relative speed of formation of the space lattice of the vulcanized material was evaluated by the size of the equilibrium constant and the maximum degree of swelling in benzene. Changes in tensile strength and specific elongation during the irradiation process were studied. The optimum vulcanization regime was chosen and the basic physico-mechanical characteristics of the vulcanized materials were defined. Changes in the properties of the irradiated vulcanized material during hot aging at temperatures of 150, 200, and 250°C were studied. Irradiation in vulcanization removes the necessity for carrying out the process at high temperatures and for keeping the product under controlled temperature conditions for long periods after vulcanization. This new method of vulcanizing allows the use of carbon black as a filler. The use of ionizing radiation makes it possible to simplify the technique of vulcanizing silicon rubber and to improve the properties of the vulcanized material. (auth)

21531

STUDIES ON THE GAMMA-INITIATED POLYMERIZATION OF VINYL ACETATE IN AQUEOUS MEDIA. S. Okamura, T. Motoyama, T. Manabe, and H. Inagaki. p.361-73 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

1. Gamma-initiated polymerization of vinyl acetate in an aqueous solution of uranyl acetate. From a consideration of the rate and degree of polymerization of the gamma-initiated polymerization of vinyl-acetate in three systems (vinyl acetate-acetic acid, vinyl acetate-acetic acid, water, and vinyl acetate-acetic acid-water-uranyl acetate), the G values of each component for the initiation of polymerization are estimates as follows G(vinyl acetate) = 10.6, G(acetic acid) = 52, G(water) = 480, G(uranyl acetate) = 23,000. 2. Gamma-initiated polymerization of vinyl acetate in aqueous solutions of detergents. The emulsion polymerization of vinyl acetate in the presence of anionic, cationic, and nonionic detergents is discussed. The rate is found to be greatest for the anionic detergent lauryl benzene sulfonate. The rate and degree of polymerization increase with detergent concentration. It is found that the rate of polymerization is $\propto (\text{Intensity})^{0.25}$. (auth)

21532

RESEARCH ON THE PRIMARY PROCESSES OF RADIATION-INITIATED POLYMERIZATION. S. Okamura, T. Manabe, T. Higashimura, Y. Oishi, and S. Futami. p.391-405 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Excitation energy transfer in benzene solutions of monomers, polymers and copolymers was studied by observations on the quenching of terphenyl fluorescence produced by gamma radiation. The ease of energy transfer from benzene to various monomers is conjugated monomers > unconjugated > monomers > corresponding saturated compounds. Quenching experiments were also carried out using polymer solutions in benzene. The order of efficiencies was crepe rubber > polystyrene > polyvinyl acetate > acrylic polymers. The results obtained for quenching by a styrene-methyl methacrylate copolymer indicated that the specific quenching efficiency of the styrene units in the copolymer was less than in the homopolymer. The gamma ray initiated polymerization of styrene in methylene dichloride solutions at low temperatures was studied. The results obtained for the dependence of polymerization rate on intensity are consistent with an ionic mechanism. The composition of the copolymer obtained with methyl methacrylate also supports this view. (auth)

21533

RADIOINITIATION OF CHAIN BRANCHED REACTIONS AND ITS SENSITIZATION. E. V. Barelko, L. I. Kartashova, P. N. Komarov, and M. A. Proskurnin (Karpov Physico-Chemical Inst., Moscow). p.407-21 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy, 1960. (In Russian)

The results of experiments with radioinitiation of chain branched reactions of the oxidation of organic compounds are given. The function of radiation as an initiating agent is described with reference to the oxidation of several unsaturated hydrocarbons and butanol. The reaction is self-accelerating and proceeds spontaneously after radiation has ceased. A detailed investigation was made of a process from oxidizing benzene, which has a high radiation resistance. A method was devised for sensitizing the radioinitiation of the oxidation of radiation-resistant substances by

chemically inert but non-radiation-resistant substances. The main quantitative features of the process for the radiooxidation of benzene are the accumulation of various reaction products and the effect of temperature, pressure, power, and radiation dosage on the process of such accumulation. Information was obtained about the mechanism of the process. The design of circulating equipment is described. (auth)

21534

SYNTHESIS OF GRAFT COPOLYMERS BY SMALL DOSES OF IRRADIATION. J. Dobo, M. Somogyi, and L. Kiss. p.423-31 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

In addition to grafting, there is often an undesirable alteration in the properties of the original polymer when polymer monomer mixtures are irradiated. As a result of irradiation, grafting occurs not only on the original polymeric backbone, but also on the already grafted sidechains. The result is an acceleration of grafting. The effect is especially pronounced in the case of preformed polymers if irradiation is carried out intermittently. The grafting of styrene can be accelerated by the addition of some solvents which suppress the protective effect of the styrene on the polymer. Grafting can be accelerated by other additives. The swelling properties of the irradiated films were investigated. (auth)

21535

THE PREPARATION OF GRAFT POLYMERS OF ACRYLONITRILE AND POLYDIMETHYLSILOXANE BY MEANS OF Co^{60} GAMMA RAYS. F. L. Dalton and R. Roberts. p.433-46 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

A dilatometric study of the rate of polymerization of acrylonitrile in polydimethylsiloxane fluids was made. The polymerization was carried out in air and in vacuum. The effects of monomer concentration, radiation intensity, and temperature on the polymerization were determined. The reaction is found to be kinetically similar to the aqueous solution polymerization of acrylonitrile and a mechanism similar to that put forward by Dainton for the polymerization of acrylonitrile is invoked. At first small radicals grow by rapid addition of monomer. These radicals can undergo termination in a conventional manner. Subsequently there is a slow growth of radicals present in stable suspended particles by the addition of adsorbed monomers. These radicals terminate very slowly as the particles diffuse together. (auth)

21536

RADIATION INDUCED GRAFT COPOLYMERIZATION OF POLYVINYL ALCOHOL. Ichiro Sakurada, Toshio Okada, and Eiko Kugo. p.447-58 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The graft copolymerization of various vinyl monomers to polyvinyl alcohol films by gamma ray irradiation was investigated. When thin films of polyvinyl alcohol were irradiated in a large excess of styrene no graft copolymerization was observed. With films containing more than 5% water the grafting proceeded smoothly. The highest value of styrene grafted was about 1,000% at a dose of 7×10^6 r. The presence of water in the monomer solution was found to increase considerably the amount of grafted monomer. Methyl methacrylate behaved similarly to styrene in the grafting to polyvinyl alcohol films, the presence of a certain amount of water being essential. The efficiency of the grafting of methyl methacrylate was generally larger than that of the grafting of styrene. The highest value of the grafted methyl methacrylate was 4,000% and obtained at a dose of 5×10^5 r. Some experiments were carried out with acrylonitrile and vinyl acetate but compared with styrene and methyl methacrylate the efficiencies of the grafting of these monomers were not so high. The degree of swelling of the graft copolymers of polyvinyl alcohol-styrene or -methyl methacrylate in organic solvents was measured at 30°C. The relation between the degree of swelling and the percentage of monomer grafted was given by degree of swelling $\% = k\,(\text{monomer grafted }\%)^n$. For polymers grafted with styrene $n = 1$, but for those grafted with methyl methacrylate $n < 1$. n and k have characteristic values which depend on the solvents used. (auth)

21537

GAMMA-RAY-INITIATED GRAFT COPOLYMERIZATION ON THE SURFACE OF NYLON FIBERS AND IN THE INNER LAYERS OF CELLULOSIC FIBERS. S. Okamura, T. Iwasaki, Y. Kobayashi, and K. Hayashi. p.459-70 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Crosslinks are formed as a result of the irradiation of nylon fibers in an atmosphere of nitrogen whereas degradation takes place on irradiation in air. Changes taking place on irradiation were studied by measurements of the viscosities of the irradiated fibers in sulfuric acid solutions. The tensile properties were also examined in air. If nylon fiber is irradiated in nitrogen, dipped in an aqueous solution of acrylamide and irradiated, grafting takes place only on the surface. When the preliminary irradiation is carried out in air, grafting takes place within the fiber. The location of the graft polymer is obtained by dyeing the fiber. The extent of grafting of cellulose fibers with styrene from methanol solution is very considerably increased if the cellulose fibers are swollen in a 5 to 10% solution of formamide in methanol. The effect of the concentrations of formamide and styrene in the methanolic solutions was studied and maximum grafting was found to occur at 5% formamide and 70% styrene concentrations. At dose rates of the order of 10^5 r/hr it was found that the rate of grafting was diffusion controlled. (auth)

21538

THE RADIATION INDUCED GRAFT COPOLYMERIZATION OF METHACRYLIC ACID TO NYLON. R. Roberts and J. K. Thomas. p.471-8 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The grafting of methacrylic acid to nylon by the preirradiation technique was studied. The rate of grafting is appreciably larger than that of homopolymerization. No simple relation exists between reaction rate and total dose. The temperature dependence of the rate of grafting to the fibre, preirradiated in air, indicates that initiation of grafting is likely to take place by decomposition of peroxide groups formed on irradiation. Electrical resistance measurements on the irradiated fibre indicate that the resistance is reduced by a factor of 10. (auth)

21539

IMPROVEMENTS IN OR RELATING TO USE OF NUCLEAR FISSION IN SYNTHESIZING ORGANIC COMPOUNDS. (to Hercules Powder Co.). British Patent 838,361. June 22, 1960.

A process is presented for the production of organic molecular fragments and the recombination of the fragments into the desired organic compounds by irradiation. (W.L.H.)

21540

SUPPRESSION OF WATER DECOMPOSITION. A. O. Allen and C. J. Hochanadel (to U. A. Atomic Energy Commission). U. S. Patent 2,937,981. May 24, 1960.

Gaseous decomposition of water exposed to a nuclear reactor neutron flux is suppressed by maintaining dissolved hydrogen in the water from an external source at a concentration of approximately 60 to 760 micromoles per liter throughout the period of exposure of the water to the neutron flux.

Raw Materials and Feed Materials

21541 ANL-5811

Argonne National Lab., Ill.

A LABORATORY INVESTIGATION OF THE FLUORINATION OF CRUDE URANIUM TETRAFLUORIDE. O. Sandus and R. K. Steunenberg. Dec. 1957. Decl. Mar. 30, 1960. 32p. Contract W-31-109-eng-38. OTS.

Ore concentrates were converted directly to crude uranium tetrafluoride by hydrogen reduction and hydrofluorination in fluidized-bed reactors. Small-scale laboratory experiments demonstrated that this process can be extended to the production of crude uranium hexafluoride through fluorination of the uranium tetrafluoride in a fluidized bed. The satisfactory temperature range for the reaction lies between 300 and 600°C. At 450°C the fluorine utilization is between 50 and 80%. With excess fluorine, over 99% of the uranium is volatilized from the solid material. The fluidization characteristics of certain materials are improved by the addition of an inert solid diluent to the bed. (auth)

21542 CF-57-2-113

Oak Ridge National Lab., Tenn.

PREPARATION OF THORIUM OXIDE FROM ORNL THOREX THORIUM NITRATE. W. T. McDuffee and O. O. Yarbro. Feb. 13, 1957. Decl. May 4, 1960. 13p. OTS.

Thorium nitrate, removed from irradiated Th metal processed in the Thorex pilot plant, was converted to the oxide and then to the fluoride in one pilot-plant-scale and two laboratory-scale runs. Activity distributions, decontamination factors, and safety of the process are treated. (D.L.C.)

21543 CF-60-7-59

Oak Ridge National Lab., Tenn.

PILOT PLANT PREPARATION OF THORIUM OXIDE AND THORIUM–URANIUM OXIDE DURING FISCAL YEAR 1960. R. H. Winget, Jr. July 29, 1960. 18p. Contract [W-7405-eng-26]. OTS.

Test quantities of thoria (approximately 3800 lb of thorium oxide and 3200 lb of mixed thorium-uranium oxide) were prepared during FY-1960 for members of the Reactor Experimental Engineering Division (REED). For preparation of thorium oxide, the calcination temperature was varied from 650 to 1600°C. The surface area of the fired oxide ranged from 0.5 to 25 m^2/g and the mean particle size ranged from 1 to 8 microns. For preparation of mixed thorium–uranium oxide, the calcination temperature was varied from 1050 to 1225°C. The mixed oxide contained either 0.5, 3.0, or 8.0 wt.% of uranium as requested with a mean particle size of 2.5 microns. The over-all losses of thorium and uranium were 19.4 and 18.3%, respectively. Four 1400 lb batches of thorium nitrate were dissolved to prepare solutions containing 300 to 350 g/liter of thorium for solvent extraction studies in the Chemical Technology Division and 2100 lb of dry, recovered waste thorium oxide was supplied to the ORNL Fuel Cycle Program. (auth)

21544 K-1377

Oak Ridge Gaseous Diffusion Plant, Tenn.

TESTING OF KARBATE AND IMPERVITE IN BOILING AND CONDENSING HYDROGEN FLUORIDE AZEOTROPE. O. J. Malacarne and J. H. Pashley. Apr. 15, 1958. Decl. Jan. 11, 1960. 18p. Contract W-7405-eng-26. OTS.

Boiler-condenser units, fabricated on Karbate and Impervite (resin-filled graphites), have exhibited excellent resistance to boiling and condensing hydrogen fluoride–water solutions of azeotropic concentration (38% acid). No visible attack on the heat transfer surfaces of either unit was observed after operation at total reflux for over 5,000 hours. Standard tensile and compressive strength tests indicated no significant weakening of the Karbate, and chemical analyses indicated a low fluoride content consistent with the porosity of the material. It was concluded that both materials should be satisfactory for plant service with aqueous hydrogen fluoride of at least the azeotropic concentration, and temperatures of at least 300°F, providing the structural limitations are recognized in design and operation. (auth)

21545 KLX-013

Kellex Corp., New York.

URANIUM REFINERY PROPOSAL. May 31, 1949. Decl. Mar. 15, 1960. 38p. OTS.

Attached to this report is a letter containing pertinent data, from A. L. Baker, dated May 31, 1949. 2p.

The design of a plant for production of purified brown oxide (UO_3) from uranium-bearing ores is presented. (J.R.D.)

21546 MCW-1413

Mallinckrodt Chemical Works, St. Louis.

PROCESS DEVELOPMENT QUARTERLY REPORT. PART II. PILOT PLANT WORK. Barbara Elliott, ed. May 1, 1958. Decl. May 4, 1960. 106p. Contract W-14-108-eng-8. OTS.

A plant green salt reactor equipped with a fluid bed reduction unit was operated experimentally at successively lower HF rates until a level of 1.1 times theory was reached. The results indicate that metal-grade green salt can be produced at rates of 600 lb UF_4/hr or better at this low acid excess level if certain equipment modifications are made. Increases in liner thickness may insulate the bomb cavity and delay the ignition of a dingot bomb; trials of this technique as a possible substitute for magnesium filming show interesting effects on hydrogen control but insufficient benefit to warrant abandoning filming at this time. Explorations of temperature gradients within the 3300-pound bomb during preheat demonstrate that all hydrogen available from UH_3 in the liner should be released prior to bomb ignition. Optimum performance to date in gamma phase extrusion has been obtained with the use of chromium carbide shear-type dies and a minimum of lubrication, elimination of flow cones, a minimum preheat of 1850°F, and employment of convex billet butts with matching concave graphite follower blocks preheated to the billet temperature. (auth)

21547 MCW-1425

Mallinckrodt Chemical Works, St. Louis.

PROCESS DEVELOPMENT QUARTERLY REPORT. PART I. LABORATORY WORK. John Nelson, ed. Jan. 2,

1959. Decl. May 12, 1960. 142p. Contract W-14-108-eng-8. OTS.

The fraction of uranium in Vitro, Climax, Uravan, and Uranium Reduction concentrates insoluble in nitric acid was not decreased by digestion pressures of 70 to 100 psig and digestion temperatures up to approximately 170°C. The rate of solution of the soluble uranium was, however, improved by these more severe digestion conditions. Evaluation of samples of plant streams indicate that the decontamination efficiency of the Weldon Spring refinery is principally limited by entrainment of aqueous phase during the extraction operations rather than by any chemical effects. The measurement of x-ray-diffraction line profiles of UO_2 provides a technique for measuring the relative importance of crystallite size and lattice strain in determining the reactivity of UO_3. The specific conductance of hydrofluoric acid solutions ranging in concentrations from 10 to 40% was measured over the temperature range 30 to 90°C. These data were needed to provide a control mechanism for the low excess acid flow sheet. The hydrogen contamination in metal from laboratory scale bombs is increased by increasing the hydrogen pressure in the bomb prior to firing. The decrease in pressure observed during firing correlates well with the quantity of hydrogen in the metal produced. Metal yields fall off with increased prefiring pressure. Correlation of metal hydrogen with bomb center temperature at firing was good, and showed a correspondence between plant and laboratory bombs. The addition of UF_3 to bomb or liner drastically shortened the pre-heat time before firing. Diffusion coefficients for hydrogen in uranium were measured in the alpha, beta, and gamma phases. Values for dingot metal range from 6.4×10^{-5} sq cm/sec at 800°C to 1.5×10^{-4} sq cm/sec at 970°C. Hydrogen was found to be soluble in molten magnesium fluoride to the extent of 32 ppm at a pressure of 760 mm of Hg at a temperature of 1265°C. This solubility is a linear function of the hydrogen partial pressure. Combination of these results with those for hydrogen solubility in molten uranium indicates that the hydrogen distribution in the dingot is not an equilibria. Formation of magnesium hydride was found to occur by reaction of hydrogen with finely divided magnesium obtained by thermal decomposition of magnesium hydride. With magnesium of normal surface area, the hydriding reaction occurs at too slow a rate to be significant. The evaluation of x-ray methods for predicting the dimensional stability of uranium fuel elements under irradiation was begun. Instrumental conditions and the choice of calculation strategy greatly alter the values obtained for the Texture Coefficient, and hence the evaluation of the growth potential of a particular structure. The rate of dissolution of uranium metal in nitric acid is catalyzed by moderate pressures of NO_2. The use of dibenzoylmethane to determine uranium in the range of 0.03 to 0.3 mg is being investigated. The precision at the 95% confidence level is ±0.01 mg of uranium. Only vanadium(V), antimony(V), mercury(II), cerium(IV), and thorium(IV) cause serious interference problems. (auth)

21548 MCW-1426

Mallinckrodt Chemical Works, St. Louis.

PROCESS DEVELOPMENT QUARTERLY REPORT. PART II. PILOT PLANT WORK. Patricia Fain, ed. Feb. 2, 1959. Decl. May 12, 1960. 112p. Contract W-14-108-eng-8. OTS.

Experimental pilot plant studies of the air-deficient combustion of propane showed that the available burner produced an atmosphere of 13 to 14% CO + H_2. Comparison of the performance of pilot plant and refinery extraction and re-extraction equipment established the scale-up relationship between the two systems. Experiments with the pilot plant pumper-decanters showed that a substantial improvement in efficiency results from the maintenance of interfaces in the decanters. Suspension of solvent treatment for one week in the refinery caused a 20% capacity loss in the re-extraction column. Sulfuric acid treatment of solvent in the pilot plant pulse column reduced the uranium concentration in the solvent below 0.05 g uranium per liter. Several experimental runs in the pilot plant fluid-bed denitrator have shown that particle growth by agglomeration is the prevailing mechanism. Stable particle size distribution results over a wide range of operating conditions. A correlation was developed between initial and final average particle size and the grinding rate for Destrehan Street UO_2 and UF_4 in a micronizer. Dingots produced using experimental grades of magnesium were equal in firing time, yield, and level of the chemical impurities tested to dingots produced using standard magnesium. The variation of hydrogen results from dingots produced using individually blended ingredients is significantly lower than from dingots produced from unblended materials. Control of dingot hydrogen at levels below 2.0 ppm appears feasible by heating the green salt-magnesium blend (either in the bomb or separately) to temperatures of 600 to 700°F before firing. Vacuum outgassing of dingot uranium to remove hydrogen appears possible either in a direct pour of liquid metal from the bomb or as 7-inch-diameter rounds in the gamma phase temperature range after extrusion. (auth)

21549 NLCO-672

National Lead Co. of Ohio, Cincinnati.

BRIQUETTED URANIUM TETRAFLUORIDE—MAGNESIUM BLEND FOR BATCH REDUCTION CHARGES. George E. Wuller, Jr. Dec. 21, 1956. Decl. Mar. 16, 1960. 15p. Contract AT(30-1)-1156. OTS.

A production-scale operation using briquetted UF_4—Mg blend as the charge in the reduction of UF_4 to massive U metal was demonstrated to be feasible. Use of a briquetted charge ($11\frac{1}{2}$-inch-diameter briquettes) gave consistently high yields and increased reduction capacity. Thus, an economic advantage over the loose-charge process was demonstrated. (auth)

21550 NYO-1316

Mallinckrodt Chemical Works, St. Louis.

A SUMMARY REPORT OF ALL PILOT PLANT WORK DONE IN DEVELOPING A CONTINUOUS PROCESS FOR THE PRODUCTION OF UF_4. E. K. Teter. Dec. 22, 1950. Decl. Mar. 7, 1960. 23p. OTS.

All the UF_4 production recorded in this report was made by the reaction $UO_2 + 4HF \rightleftharpoons UF_4 + 2H_2O$. UO_2 was fed by a screw feeder to a horizontal tubular reactor and conveyed through the reactor by some type of screw conveyor. Anhydrous HF in gaseous form was introduced to the reactor at the discharge end, to give countercurrent flow, and the exhaust gases were removed at the feed end of the reactor. Heat was applied externally to the reactor during the process. Experiments with various metals and alloys have shown Illium-R (rolled) to be the best material of construction for both conveyors and reactors. The conveyor is a flat, triple-flight, long-pitch conveyor which has no shaft. Deflectors, welded to the inside surfaces of the flights, convey and mix the reactor material. Spacers keep the flights apart and give additional strength. This type conveyor discharges a product which is uniformly fluorinated and free of lumps or cake. The continuous process was found to operate smoothly, less caking and lumping and therefore better fluorination, if the UO_2 was gradually brought up, from a maximum of 800°F at the feed inlet, to

the maximum operating temperature of 1150°F. This temperature gradient was best controlled with electric heating. Usage of 0.6 lb anhydrous HF per lb UO_2 charged was satisfactory. The different conveyors and pilot plants that were in use successively during the development of the process are illustrated. (W.L.H.)

21551 NYO-1360
Mallinckrodt Chemical Works, St. Louis.
PROCESS DEVELOPMENT QUARTERLY REPORT, PART II. W. M. Leaders, E. I. Miller, et. al. Jan. 15, 1954. Decl. Mar. 24, 1960. 146p. Contract W-14-108-eng-8. OTS.

Progress of the work is outlined on the extraction of $UO_2(NO_3)_2$ using a 4-in. jet mixer column, processing of impure green salt, de-etherized raffinate filtration, development of by-product MgF_2 slag as a liner for bomb reduction and of improved production molds for U casting, investigation of ceramics for U casting, testing of methods for determining the density of 20-lb U ingots, UF_6 reduction to U metal, investigation of crucibles for casting and melting ore, recovery of U from recycle slag, metal dissolving process for recovery of U metal scrap, processing of new plant feed materials and Fernald $UO_2(NO_3)_2 \cdot 6H_2O$, and the production of depleted U–Mo alloy. (For preceding period see NYO-1358.) (W.L.H.)

21552 NYO-5234
Mallinckrodt Chemical Works, St. Louis.
THE USE OF PORO CARBON TUBES FOR DUST REMOVAL. K. Eckberg. May 15, 1950. Decl. Mar. 7, 1960. 8p. OTS.

An investigation was undertaken to determine the feasibility of using poro-carbon tubes for removal of the dust from effluent HF gas of a continuous UF_4 reactor. Tabulated results indicated that the dust removal by this means was satisfactory. A diagram of the filter is shown. (W.L.H.)

21553 NYO-5254
Mallinckrodt Chemical Works, St. Louis.
A REPORT ON THE FILTRATION OF TBP SLURREX RAFFINATE. W. G. Weber. [nd]. Decl. Mar. 24, 1960. 25p. OTS.

The problem of selection of an adequate filter for filtration of TBP (tributyl phosphate) slurex raffinate is discussed. Pilot plant data are presented concerning test work with settling of slurries, filtrations on a 0.1 ft^2 test leaf, Feinc filtrations, pressure tube filtrations, and Oliver precoat filtrations. Process recommendations and limitations are presented for use of an Oliver precoat filter. (auth)

21554 ORNL-2117
Oak Ridge National Lab., Tenn.
FLUOROX MOVING-BED PROCESS FOR PRODUCING UO_3, UF_4, AND UF_6: BIBLIOGRAPHY. J. E. Moore. Aug. 21, 1956. Decl. Mar. 28, 1960. 22p. Contract W-7405-eng-26. OTS.

A bibliography of 105 reports on the Fluorox moving-bed process is given. The reports are arranged in sections on ORNL summary reports, ORNL periodic reports, other reports on moving-bed reactors, production of UO_3, production of UF_4, production of UF_6, and corrosion. (D.L.C.)

21555 ORNL-2216
Oak Ridge National Lab., Tenn.
LABORATORY DEVELOPMENT OF THE FLUOROX PROCESS: II. THERMOGRAVIMETRIC STUDY OF THE CHEMICAL KINETICS FOR THE REACTION OF UF_4 WITH DRY OXYGEN. L. M. Ferris and E. G. Carter. May 24, 1957. Decl. Mar. 31, 1960. 28p. Contract W-7405-eng-26. OTS.

Rate constants for the reaction $2UF_4 + O_2 \rightarrow UF_6 + UO_2F_2$ were determined by a thermogravimetric method. Thermobalance operation, data treatment, and tentative rate constants are presented for the temperature range 625 to 815°C. (auth)

21556 TID-7501(Pt.1)
Division of Raw Materials, AEC; Oak Ridge National Lab., Tenn.; Argonne National Lab., Ill.; Union Carbide Nuclear Co. K-25 Plant, Oak Ridge, Tenn.; and National Lead Co. of Ohio, Cincinnati.
ACTIVE PROCESS DEVELOPMENT ACTIVITIES FOR PROCESSING OF FEED MATERIALS. Jan. 1956. Decl. Mar. 31, 1960. 129p. OTS.

The carbonate and organic leaching processes for the recovery of U from its ores are outlined. The Excer process (ion-exchange conversion and electrolytic reduction) and the Fluorox process (starch–HF reaction) for the production of UF_4 from ore concentrate and depleted reactor fuels are described. The fluidized-bed process for UF_4 production from $UO_2(NO_3)_2$ is also described. Methods for improving the reactivity of UO_3 and mechanical and thermal processes for increasing the density of UF_4 were investigated. Applications of fluoride volatility processes to feed materials are discussed. (C.W.H.)

21557
FLOTATION SEPARATION OF CARBONATE FRACTION FROM URANIUM ORES. Jan Jančárek and Jaroslav Cibulka (Inst. of Research in Mineralogy, Prague). Jaderná energie 6, 239(1960). (In Czech.)

A laboratory and pilot studies of the flotation of carbonate minerals in uranium ores containing sulfide minerals and graphite was carried out by two stage flotation. In the first stage graphite and most sulfides were separated by means of kerosene [640 g/t], trichloroethylene [1180 g/t], pine oil [100 g/t], and water glass [800 g/t]. In the second stage carbonates are separated from silicates with oleic acid [600 g/t]. The vaporization selection of uranium does not occur, only the graphite concentrate is poorer. The minerals without graphite are flotated in a single stage. (auth)

21558
IMPROVED CONTINUOUS PROCESS FOR THE CONVERSION OF UF_6 TO UF_4. Seymour Howard Smiley, Donald Carl Brater, and Robert Hayward Nimmo. (to United States Atomic Energy Commission). British Patent 842,500. July 27, 1960.

A continuous process is described for the conversion of UF_6 to UF_4. The process consists of continuously introducing gaseous UF_6, fluorine, and hydrogen into a reaction zone, collecting the resulting UF_4 powder, and continuously withdrawing the resulting gases from the reaction zone. (W.L.H.)

Separation Processes

21559 ANL-6145
Argonne National Lab., Ill.
CHEMICAL ENGINEERING DIVISION SUMMARY REPORT FOR JANUARY, FEBRUARY, MARCH 1960. 191p. Contract W-31-109-eng-38. OTS.

Chemical-Metallurgical Processing. A direct-cycle fuel-reprocessing plant using pyrometallurgical procedures is being designed as part of the Experimental Breeder Reactor No. II project. The reduction of uranium oxide was investigated, using pure Mg and solutions of Mg in Zn and Cd. Cadmium solutions of U were shown to be stable in Types

405 and 410 stainless steel containers at temperatures up to 550°C. The liquid metal corrosion loop in which a U–Mg–Cd alloy is being circulated at 550°C has been in trouble-free operation for 3000 hrs. Recovery of Pu from Mg solution by distillation of Mg was demonstrated on 1-g Pu scale. The solubility of Th in liquid Cd was measured over the temperature range from 1.9×10^{-3} per cent at 348°C to 1.8×10^{-2} per cent at 658°C. The solubility of Mn in liquid Cd was found to range from 0.27% at 414°C to 1.43% at 661°C. The solubility of Ni in liquid Cd was measured. The partition of U between liquid Al and liquid Cd was studied as a function of U concentration. The reaction of Al with a liquid Cd solution containing U, Zr, and Ce was studied. The free energy of formation of the U–Pb intermetallic compound UPb_3 was measured between 374 and 846°C by means of a galvanic cell method. Magnetic susceptibility measurements on the intermetallic compound $CeCd_{11}$ were made over a range of temperature from 4 to 295°K. Fuel Cycle Applications of Volatility and Fluidization Techniques. The Direct Fluorination Process is currently aimed toward the processing of the Zircaloy-clad, UO_2 fuel typical of the Dresden Reactor. The direct fluorination of dense UO_2 pellets submerged in an inert fluidized medium was carried out in a 3-inch reactor at 500°C at fluorine concentrations up to 30%. Experimental work has continued to determine the mechanism of the nickel–fluorine reaction. In the development of the ADF process, current emphasis is being directed toward recovery of U from low U–Zircaloy-2 fuel alloys. A series of four dissolutions was carried out semicontinuously in the graphite pilot plant dissolver according to the Fused Salt Fluoride Volatility Process flowsheet. Additional studies of the one-step fluid-bed process for the conversion of UF_6 to UO_2 with steam and hydrogen are reported. Reactor Safety. The oxidation, ignition, and combustion processes of U, Zr, Th, and Pu are being studied in order to provide information leading to an understanding of the reactions. Reactor Chemistry. Data are being obtained on the neutron capture cross sections of U^{236} as a function of neutron energy. The Reactor Decontamination Program is directed principally to boiling water reactors. A stainless steel loop simulating the action of a boiling water reactor was operated with Y^{90} and Cs^{137} tracer activities. A program of research directed toward the selection and evaluation of materials for nuclear superheaters was initiated. (For preceding period see ANL-6101.) (W.L.H.)

21560 CEA-1427

France. Commissariat à l'Énergie Atomique, Centre d'Etudes Nucleaires, Saclay.

LES APPAREILS D'EXTRACTION UTILISES DANS TRAITEMENT DES COMBUSTIBLES IRRADIES. (Extraction Apparatus Used in the Treatment of Irradiated Fuels). P. Faugeras and X. Talmont. 1960. 53p.

The two qualities necessary in an extractor in the case of solvent extraction of radioactive materials are that they should occupy little space and require little maintenance. Various types of apparatus designed to this effect are examined. First mixer-decanter types with mechanical shaking and with shaking and decantation ultrasonically accelerated, then pulsed columns, and finally hydrocyclones are discussed. The chemical engineering studies peculiar to the running, supply, and control of each of these extractors are described in detail. In certain cases some results obtained on radioactive solutions on a pilot scale are given. (auth)

21561 CF-51-8-162

[Oak Ridge National Lab., Tenn.].

SOLVENT EXTRACTION STUDIES: PULSE GENERATORS. Quarterly Report for May 10, 1951 to August 10, 1951. A. C. Jealous. Aug. 17, 1951. Decl. Mar. 23, 1960. 13p. Contract [W-7405-eng-26]. OTS.

Piston and bellows type pulse generators are under study to determine the most effective and economical assembly for optimum pulse column operation for use in the Purex Recovery and other programs. (F.S.)

21562 CF-52-11-39

Oak Ridge National Lab., Tenn.

DESIGN OF THE DISSOLVER OFF-GAS SYSTEM FOR THE IDAHO CHEMICAL PROCESSING PLANT. John M. Holmes. Nov. 5, 1952. Decl. Mar. 23, 1960. 41p. OTS.

Pertinent calculations for the WN System adsorption units were carried out on heat transfer, heat exchangers, and adsorption beds. Static and dynamic adsorption data are presented for Kr, Xe, CO, and N_2 on charcoal. (D.L.C.)

21563 CF-57-1-149

Oak Ridge National Lab., Tenn.

THOREX PILOT PLANT: SYSTEM FOR CONCENTRATING SECOND URANIUM. W. L. Albrecht. Jan. 28, 1957. Decl. May 4, 1960. 25p. Contract W-7405-eng-26. OTS.

A system for concentrating uranyl nitrate solutions was designed and installed in the Thorex Pilot Plant. A total of 16,060 g of uranium was concentrated in the system in 68 batch runs. A total of 14,400 g total uranium (14,180 g U^{233}) was recovered as product suitable for shipment. Uranium loss to the evaporator condensate was 0.03% of the total uranium processed. The material balance across the system was 98.4%. The average concentration of uranium in the evaporator feed solution was 29 g/liter; the average concentration in the evaporated solution was 298 g U/liter and in the product solution was 199 g/liter. Radiation readings of bottles containing product solutions were taken with a hard-shell cutie pie immediately after each run, and these readings ranged from 35 to 1100 mr/hr. The radiation levels of the bottles of product solution shipped averaged 78 mr/hr. Bottles of product solution reading in excess of 300 mr/hr, maximum allowable for shipment, were reprocessed in the second-cycle solvent extraction system (Thorex) and reconcentrated. The products from seven runs had radiation levels in excess of 300 mr/hr at the time of concentration, or the activities had grown to that level by the time of shipment. The procedures used in the operation of the above system are described in detail. (auth)

21564 CF-59-6-74

Oak Ridge National Lab., Tenn.

STATUS AND FUTURE PROGRAM OF HOMOGENEOUS REACTOR FUEL PROCESSING STUDIES. W. D. Burch, P. A. Haas, and R. A. McNees. June 17, 1959. 5p. Contract [W-7405-eng-26]. OTS.

The behavior of insoluble corrosion products in the HRT is generally understood and studies of the removal of these solids by hydroclones can logically be terminated after the effect of higher processing rates by the multiple hydroclone has been determined. Chemical descaling may be required to supplement solids removal by hydroclones. Laboratory studies to find suitable reagents will be continued in conjunction with decontamination work presently in progress. Rare earth solubility levels and thus poison fraction from this group will be measured after the addition of significant quantities of four important elements has minimized analytical detection problems. The role of the tellurium precursor in the interpretation of iodine behavior will be examined extensively in the present run in an effort to resolve previous discrepancies. Studies of iodine behavior can be continued after shutdown of the hydroclone system if

required. An electrolytic process for removal of nickel from fuel solution has been developed through the laboratory and engineering scale except for the design and testing of a cell suitable for radioactive environments. (auth)

21565 CF-60-6-1
Oak Ridge National Lab., Tenn.
McCABE-THIELE GRAPHICAL SOLUTION OF URANIUM–THORIUM PARTITIONING FROM 30% TBP-AMSCO SOLVENT. A. D. Ryon. June 1, 1960. 11p. Contract W-7405-eng-26. OTS.

A graphical method based on the McCabe-Thiele diagram was utilized to define operable flow ratios and to calculate the number of theoretical stages required for partition of U and Th from 30% TBP–Amsco 125-82 solvent. (auth)

21566 CF-60-6-84
Oak Ridge National Lab., Tenn.
URANIUM RECOVERY FROM LAPRE-II FUEL SOLUTION BY TBP EXTRACTION. J. R. Flanary. June 24, 1960. 10p. OTS.

A feed preparation and solvent extraction flowsheet was developed for the recovery and decontamination of highly enriched uranium from the LAPRE-II reactor fuel solution. The fuel solution, U(IV) in concentrated H_3PO_4 was diluted, $Fe(NO_3)_3$ added to complex phosphate and supply salting strength, $NaNO_2$ added to oxidize U(IV) to U(VI) so that U may be extracted efficiently with 6% TBP. The flowsheet is designed for operation in noncritically safe equipment. (auth)

21567 CN-3627
Argonne National Lab., Ill.
SEPARATIONS PROCESSES. I. Perlman. Sept. 23, 1946. Decl. Mar. 23, 1960. 75p. Contract W-31-109-eng-38. OTS.

The following processes for the separation and recovery of Pu from U and fission products are discussed: Bismuth Phosphate, Acetate Separation, Redox, Chelate Separation, and Ion Exchange. (C.W.H.)

21568 ERI-2240-7-F
Michigan. Univ., Ann Arbor. Engineering Research Inst.
STUDY OF THE FEASIBILITY OF AQUEOUS RECOVERY OF SPENT FUELS. PART 7. ANALYSIS OF COSTS AND ENGINEERING EVALUATION OF RESULTS OF STUDY. J. G. Lewis and H. A. Ohlgren. July 1954. Decl. Mar. 28, 1960. 143p. (HAO-21). OTS.

Work done for Dow Chemical-Detroit Edison and Associates, Atomic-Power Development Project at request of Consumers Power Co. (Jackson County).

A summary of engineering studies, evaluations, analyses, and projections of data and information available from aqueous chemical processing and separations technology in use at AEC installations is presented. (J.R.D.)

21569 HW-14702
Hanford Works, Richland, Wash.
EXPLORATORY SCAVENGING STUDIES FOR THE DECONTAMINATION OF REDOX SOLUTIONS. W. E. Roake and C. S. Lowe. May 1, 1950. Decl. Mar. 24, 1960. 21p. Contract W-31-109-Eng-52. OTS.

Exploratory experiments designed to study the efficiency of several scavengers for Zr and Nb absorption in Redox solutions and to provide preliminary information on the best conditions to employ the most satisfactory scavenger found are described. The results are not considered final and the investigation is continuing. (J.R.D.)

21570 HW-17481
Hanford Works, Richland, Wash.
CLARIFICATION OF REDOX DISSOLVER SOLUTION BY CENTRIFUGATION WITH SCAVENGER. A. W. Allen. June 6, 1950. Decl. Mar. 28, 1960. 25p. Contract W-31-109-Eng-52. OTS.

Clarification of Redox dissolver solution, prepared from non-irradiated jacketed Hanford slugs, by centrifugation with Super Filtrol FO scavenger was studied on a semi-works scale using a 12-in. solid bowl Bird centrifuge. The holdup time required for maximum clarification using 1 to 2 wt.% Super Filtrol FO and centrifuge speeds producing forces of from 1600 to 2000 times that of gravity is ~30 min, but clarification adequate for plant operation is attained after holdup times of 22 to 24 min. (W.L.H.)

21571 HW-19391
Hanford Works, Richland, Wash.
DEPOSITION OF RUTHENIUM ACTIVITY ON THE OXIDIZER DURING HEAD-END TREATMENT. C. F. Callis. Nov. 6, 1950. Decl. Mar. 28, 1960. 7p. OTS.

The deposition of Ru activity on the oxidizer during head-end treatment in the Redox Process was studied. The investigation indicated that good decontamination of the dissolver solution from Ru can be achieved by head-end volatilization using $KMnO_4$ as the oxidizing agent and either ozone or nitrogen as the sparging gas. (W.L.H.)

21572 HW-64432
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
REPROCESSING URANIUM–MOLYBDENUM ALLOY FUELS—DISSOLUTION IN CONCENTRATED NITRIC ACID. W. W. Schulz. Mar. 17, 1960. 17p. Contract AT(45-1)-1350. OTS.

Dissolution of U–3 wt.% Mo alloys in 12 to 14 M HNO_3 solutions is discussed. Under these conditions 80 to 95% of the molybdenum content is precipitated as white hydrated molybdic oxide. Molybdic oxide precipitates are bulky; centrifuged volumes range from 6 to 17 vol.% for dissolver solutions 1.0 to 1.5 M U. The precipitates retain some plutonium and uranium even after thorough washing with water and 1 M HNO_3. Plutonium and uranium values in washed precipitates can be recovered by successive treatment of solid residues with caustic and nitric acid. Removal of nitric acid from uranium-molybdenum alloy dissolver solutions by boil-down procedures and by reaction with formaldehyde is discussed. Solutions obtained after removal of nitric acid constitute satisfactory low-acid Redox process feedstocks. (auth)

21573 MCW-1390
Mallinckrodt Chemical Works, St. Louis.
INTERIM REPORT ON OPERATION OF THE TBP-HEXANE EXTRACTION PILOT PLANT. L. H. Krone, D. J. Nerrow, and R. H. Fariss. May 22, 1956. Decl. May 4, 1960. 22p. OTS.

An extended feed test run was made to investigate U recovery and purity of the product of the pilot plant TBP–hexane extraction cycle operating on a series of different feed materials. Also investigated were operational variables in the pumper-decanter and TBP-removal systems. (W.L.H.)

21574 ORNL-1543
Oak Ridge National Lab., Tenn.
APPLICATION OF THE PULSE COLUMN FOR URANIUM RECOVERY FROM K-25 WASTES. E. Lieberman and A. C. Jealous. Nov. 19, 1953. Decl. Mar. 7, 1960. 25p. Contract W-7405-eng-26. OTS.

The flow capacity and column-height requirements for pulse-column solvent-extraction contactors were determined for recovering U from various K-25 waste solutions

at a solution processing rate of approximately 0.5 gpm. (auth)

21575 TID-5463

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

OPERATING CHARACTERISTICS OF A PODIELNIAK CENTRIFUGAL EXTRACTOR. J. H. Morgenthaler, G. T. Keene, W. L. Mann, and A. A. Wasserman. Aug. 25, 1951. Decl. Mar. 28, 1960. 30p. For Carbide and Carbon Chemicals Div. [K-25 Plant. Contract W-7405-eng-26]. (KT-110). OTS.

A study was made of the effect upon extraction of the operating variables of a Podbielniak Centrifugal Extractor. The variables studied were rotor speed, total flow rate through the extractor, and holdup in the rotor. Holdup was defined as the volume of the aqueous phase in the rotor divided by the total volume of liquid in the rotor. (W.L.H.)

21576 CEA-Tr-A-650

EXTRACTION À CONTRE COURANT À PLUSIEURS PLATEAUX, À L'AIDE D'UN NOUVEL EXTRACTEUR CENTRIFUGE À SOLVANT. (Countercurrent Extraction in Several Stages Using a New Centrifugal Solvent Extractor). H. Eisenlhor. Translated into French from Chem.-Ingr.-Tech. 23, 11-14(1951). 16p.

An extractor is described which incorporates several stages in a simple solvent-tight apparatus. Difficult separations previously requiring large blenders and mixers or several separators are possible. The Podbielnak and Coutor designs led to this device called the Luwesta separator. It is different from the Coutor in that mixing occurs on the lower plate by means of a ring outlet. In the two upper plates the light and heavy constituents are removed by a valve. Westfalia valves are used instead of the rings to give greater force and keep foam and gas from the receivers. (T.R.H.)

21577 UCRL-Trans-543(L)

STUDIES IN INORGANIC PAPER CHROMATOGRAPHY. IV. VERIFICATION OF SEPARATION OF SALTS OF METALS OF THE COPPER FAMILY, WITH APPLICATION TO SYSTEMATIC QUALITATIVE ANALYSIS. Shiro Harazawa. Translated from Nippon Kagaku Zasshi, 72, 236-9(1951). 6p. JCL.

Using paper chromatography, satisfactory separation of salts of the metals of the copper group is possible with developers of the hydrochloric acid–butanol system. No special apparatus or method was employed. (W.L.H.)

21578 UCRL-Trans-544(L)

STUDIES IN INORGANIC PAPER CHROMATOGRAPHY. VII. SEPARATION OF SALTS OF TIN AND ANTIMONY, AND ANALYSIS OF METALS OF THE TIN GROUP IN THE STATE OF HIGHER VALENCE. Shiro Harazawa. Translated from Nippon Kagaku Zasshi, 72, 423-6(1951). 6p. JCL.

When antimony salts and tin salts are treated with an HCl–butanol developer, it is possible to detect and separate the two. Separation of antimony(III) and tin(II) is incomplete, but separation of antimony(V) and tin(IV) is total. (auth)

21579

CONTRIBUTION TO THE STUDY OF ISOTOPIC EXCHANGE ON ION EXCHANGE RESINS. M. Dumitru, O. Constantinescu, and S. Ionescu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 383-96(1960). (In Rumanian)

The static exchange between the cobalt and cesium resinate and their ions in solutions of various concentrations was studied. It was found that the exchange equilibrium is more difficult to attain in the case of bivalent cobalt than in the case of the cesium monovalent ion. The dynamic exchange phenomena between Cs, Co(II), and Pr resinates in solutions containing their ions at various concentrations were followed in columns. The dynamic exchange in the case of Co(II) resinate and Co^{2+} ions in the organic solvents acetone and alcohol was studied, and it was found that in the case of large amounts of the organic solvent (90 to 100%), the exchange is strongly decreased. The scheme of a probable mechanism is given. (tr-auth)

21580

CONTRIBUTION TO THE UTILIZATION OF ORGANIC SOLVENTS AS ELUANT AGENTS IN CATION EXCHANGE. II. THE POSSIBILITIES OF SELECTIVE ELUTION OF LANTHANIDES. I. Dema, M. Dumitru, E. Gîrd, E. Gănar, A. Rugi, Şt. Spiridon, C. Sabău, O. Constantinescu, and S. Ionescu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 397-405(1960). (In Rumanian)

The possibility of using mixtures of acetone and hydrochloric acid as eluants for the separation of rare earth elements was studied. The separation of the groups La–Ce–Pr–Nd, Sm–Eu–Gd–Tb–Dy–Ho–Er, and Yb–Lu was made at ordinary temperatures. The mixtures of organic solvents and mineral acids used as eluants permit, by their composition, the variation of two parameters: the concentration of the acid and the concentration of the solvent. The methods commonly utilized appear to demand a rigorous control of the pH and the temperature. After a distillation of the organic solvent, the separated elements are obtained as chlorides. (tr-auth)

21581

SEPARATION AND CONCENTRATION PROCEDURE FOR OXYGEN ISOTOPES O^{16}, O^{17}, AND O^{18} BY DISTILLATION OF WATER IN A PRECISION DISTILLATION APPARATUS. M. Thürkauf, A. Narten, and Werner Kuhn (Universität, Basel). Helv. Chim. Acta 43, 989-1004(1960). (In German)

A five-stage precision distillation apparatus is described in which O^{17} and O^{18} in concentrations of 0.9% O^{17} and 93% O^{18} in natural water can be separated in large quantities. The concentration of O isotopes depends on the effective number of stages of the distillation apparatus. A comparison of the measured concentrations with the calculated curve for the ternary mixture H_2O^{16}–H_2O^{17}–H_2O^{18} shows good agreement between the measured and calculated values. The concentration of D along with O isotopes is also described. (tr-auth)

21582

SEPARATION OF SOME RARE EARTHS BY REVERSED-PHASE PARTITION CHROMATOGRAPHY. S. Siekierski and I. Fidelis (Inst. of Nuclear Research, Warsaw). J. Chromatog. 4, 60-4(1960) July. (In English)

Reversed-phase partition chromatography was applied to the separation of small amounts of some rare earths. Tributyl phosphate was used as the stationary phase, and the elution was carried out with concentrated HNO_3. The following separations were accomplished: (1) Ce–Nd–Pm. Eluting agent, 15.8 M HNO_3; (2) Ce–Pm–Sm–Eu–Gd–Tb. Eluting agent, 15.1 M HNO_3; and Eu–Tb–Y. Eluting agent, 11.5 M HNO_3. The method is rapid and may be carried out at room temperature. (auth)

21583

THE PRECIPITATION OF RUTHENIUM FROM NITRATE SOLUTIONS WITH INORGANIC AND ORGANIC SULPHIDES. R. L. Moore (General Electric Co., Richland,

Wash.). J. Inorg. & Nuclear Chem. 14, 38-41(1960) July. (In English)

Certain organic sulfur compounds, such as β-mercaptopropionic acid and 2,3-dimercaptopropanol-1, were found to be very effective reagents for precipitating ruthenium from nitric acid solution. The presence in the organic molecule of one or more —SH groups is essential. With trace concentrations of ruthenium, precipitation is aided by coprecipitation of a macro concentration of a heavy metal such as silver(I), copper(II), mercury(II), or molybdenum(III). Although the reaction resembles in many respects the precipitation of ruthenium with hydrogen sulfide, the precipitation is not due to the formation of sulfide ion but rather to the formation of a very sparingly soluble compound with the organic reagent. Uranium, plutonium, and most fission products other than ruthenium are not precipitated. (auth)

21584

THE SELECTIVE ADSORPTION OF HEXAVALENT URANIUM BY A NON-IONIC PHOSPHORYLATED RESIN FROM SOLUTIONS OF DI-n-BUTYL PHOSPHORIC ACID IN BENZENE. J. Kennedy, F. A. Burford, and P. G. Sammes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 14, 114-22(1960) July. (In English)

Uranium is quantitatively adsorbed by the non-ionic phosphorylated resin diethyl polystyrene-methylenephosphonate (EPMP) from 2% solutions of dibutyl phosphoric acid (HDBP) in benzene. Iron(III), lanthanum, zirconium, niobium, thorium, and mixed fission products when present in the HDBP/benzene phase are not adsorbed. Adsorption of uranium from solutions containing the complex $UO_2(DBP)_2 \cdot 2HDBP$ results in the liberation of approximately two equivalents of HDBP and is considered to occur via the mechanism: $2EPMP + UO_2(DBP)_2 \cdot 2HDBP \rightleftharpoons UO_2(DBP)_2 \cdot 2EPMP + (HDBP)_2$. The uranium is quantitatively eluted with a benzene solution of dimethyl formamide. Under low loading conditions HDBP is adsorbed in the absence of uranium as EPMP · HDBP. The selectivity for uranium is compared with the synergic enhancement of uranium extraction with combinations of non-ionic and acidic phosphorylated solvents. (auth)

21585

SOLVENT EXTRACTION OF HEPTAVALENT TECHNETIUM. G. E. Boyd and Q. V. Larson (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 64, 988-96(1960) Aug.

The extraction of Tc(VII), initially contained in aqueous acid, neutral salt, and alkaline solutions, by a wide variety of immiscible organic liquids, including alcohols, ketones, ethers, esters, nitro-compounds, nitriles, amines, hydrocarbons, chloro-hydrocarbons, and organo-phosphorus and organo-nitrogen compounds dissolved in nonpolar liquids was measured. A basic oxygen or nitrogen atom in the organic molecule was necessary to effect a partition. Quantitative extraction was obtained when the active solvent also possessed an appreciable dielectric constant. Structural effects were evident and with mixtures involving alcohols synergistic actions were observed. The partitioning Tc(VII) species was shown to be the pertechnetate ion, TcO_4^-, for which the molar extraction coefficient was concentration-independent up to 10^{-3} M. Extraction generally was much more efficient from acid than from neutral salt or alkaline aqueous phases indicating that the hydronium ion possessed properties especially favoring its distribution. The extraction mechanism with amines dissolved in inactive solvents was anion exchange; with the n-alkyl phosphine oxide solutions stoichiometric complexes were formed in the organic phase; with the alcohols, ketones, and ethers the formation of a cationic complex appeared to be essential. (auth)

21586

URANIUM FUEL REPROCESSING BY THE FLUORIDE DISTILLATION METHOD. Ivo Peka (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Prague). Jaderná energie 6, 228-34(1960). (In Czech.)

Methods are described for reprocessing irradiated nuclear fuel by fluoride distillation. A method operating at 120°C using BrF_3 as fluorination agent, a high temperature method operating in fused salts $NaF + ZrF_4$, and a method using fluidization techniques for production of UF_6 are described. (auth)

21587

SOLUBILITY OF URANYL SALTS IN ORGANIC ESTERS. Mária Szilágyi. Magyar Tudományos Akad. Atommag Kutató Intézete (Debrecen), Közlemenyek 2, 49-52(1960). (In Hungarian)

The relations of solubility for uranyl acetate, uranyl nitrate, and uranyl sulfate were investigated in dioctyl phthalate, dibutyl phthalate, dibutyl phosphate, and tributyl phosphate. For all the three uranyl salts, dibutyl phosphate proved to be the best solvent. Tributyl phosphate is an excellent solvent for uranyl nitrate, while it is only a mediocre solvent for the other two salts. For dioctyl phthalate and dibutyl phthalate, only the latter is capable of solving uranyl nitrate to any considerable degree. The rest of the examined cases showed very low values of solubility. (auth)

21588

REMOVAL OF INTERNALLY DEPOSITED AMERICIUM BY CHELATING AGENTS. F. D. Sowby and D. M. Taylor (Royal Cancer Hospital, London). Nature 187, 612(1960) Aug. 13.

The removal of Am^{241} from rats was studied using ethylenediaminetetraacetic (EDTA) and diethylenetriaminepentaacetic (DTPA) acids. Am^{241} was injected into rats and DTPA injected at times varying from 1 hr to 7 days after Am^{241} injection and repeated at weekly intervals. The rats were killed 21 days after Am^{241} injection and the alpha activities of the liver, femur, carcass, and excreta were counted. A comparison of the results with untreated animals shows that most of Am^{241} is excreted and that practically no Am^{241} is left in the soft tissue. DTPA was found to be about twice as effective as EDTA. (D.L.C.)

21589

DISTRIBUTION OF PLUTONIUM IN TRIBUTYLPHOSPHATE EXTRACTION. II. TEMPERATURE EFFECTS ON Pu(IV) DISTRIBUTION. E. I. Moiseenko and A. M. Rozen. Radiokhimiya 2, 274-80(1960). (In Russian)

Measurements were made of the Pu(IV) distribution coefficient in 0.1 to 10 M nitric acid and 0.021 to 0.26 M uranyl nitrate at 20, 30, 50, and 70°C. With the acidity up to 5 M the distribution coefficient drops with temperature and increases with acidity. Approximate evaluations were made of the thermodynamic constants of Pu(IV) distribution, the activity coefficients in the aqueous phase, and the heat of extraction. (R.V.J.)

21590

THE INFLUENCE OF ALIPHATIC AND AROMATIC HYDROCARBONS ON TRIBUTYLPHOSPHATE SEPARATION OF U(VI), Pu(IV), Zr(IV) AND Ce(III) FROM NITRIC ACID SOLUTIONS. V. B. Shevchenko, A. S. Solovkin, I. V. Shilin, L. M. Kirillov, A. V. Rodionov, and V. V. Balandina. Radiokhimiya 2, 281-90(1960). (In Russian)

The influence of aliphatic and aromatic diluents on the tributyl phosphate extraction of U(VI), Pu(IV), Zr(IV), and

Ce(III) from nitric acid solutions was investigated. A definite bond was established between the TBP extraction properties and the organic phase polarity. Variations of polarity during the extraction process caused variations in salt distribution at high concentrations. (R.V.J.)

21591

URANYL NITRATE HYDRATION IN ORGANIC SOLVENTS DURING SEPARATION FROM SALT SOLUTIONS. V. M. Vdovenko and E. A. Smirnova. Radiokhimiya 2, 291-5 (1960). (In Russian)

Solvent extraction of uranyl nitrate from hydrous solutions by diethyl and dibutyl ethers containing salting out admixtures of KNO_3, $NaNO_3$, $Ca(NO_3)_2 \cdot 4H_2O$, and $Al(NO_3)_3 9H_2O$ was analyzed. The hydration of uranyl nitrate in diethyl ether containing salting out admixtures capable of binding water is reduced by increasing the salting agent concentrations. At identical salting agent concentrations hydration reduction depends on the water binding ability of the salt. The hydration of uranyl nitrates in dibutyl ether with salting out admixtures does not vary. (R.V.J.)

21592

PHYSICO-CHEMICAL PROPERTIES OF URANYL NITRATES, NITRIC ACID SOLUTIONS AND DETERMINATION OF THEIR COMPOSITION. T. A. Slepyan and S. M. Karpacheva. Radiokhimiya 2, 369-76(1960). (In Russian)

Specific weight, viscosity, electroconductivity, and refractive index of uranyl nitrate–nitric acid–water systems in the concentration ranges 0 to 2 M uranyl nitrate were investigated. The specific weight was calculated by the formula $d = d_0 + 0.17c_U + 0.029c_H$ with an order of accuracy of 0.5%; the index of refraction was calculated by $n = n_0 + 0.339c_U + 0.0067c_H$ with an order of accuracy of 0.2%. A method is suggested for determining the composition of the system, and a diagram is plotted of specific weight electroconductivity, and refractive index. (R.V.J.)

21593

THE SEPARATION OF CARRIER-FREE ^{234}THORIUM (UX_1) FROM URANIUM BY ANION-EXCHANGE. S. S. Berman, Lorna E. McKinney, and M. E. Bednas (National Research Council, Ottawa). Talanta 4, 153-7(1960) May.

A relatively simple procedure for the preparation of large quantities of carrier-free thorium-234 for use as a tracer was devised. A 9.6M hydrochloric acid solution of uranium was fed into an anion-exchange column. The uranium complex was adsorbed and the daughter thorium was washed through the resin bed, resulting in a substantially quantitative separation of the thorium-234 from as much as 50 g of uranium. The uranium may be readily recovered by elution with 0.1M hydrochloric acid solution, or may be left on the column to be periodically washed with 9.6M hydrochloric acid solution to produce fresh batches of thorium. (auth)

21594

DISTRIBUTION OF PLUTONIUM AND SELECTED IMPURITY ELEMENTS BETWEEN NITRATE SOLUTIONS AND TRI-n-BUTYL PHOSPHATE. E. L. Christensen, C. W. Kelley, A. J. Beaumont, and J. R. Humphrey (Los Alamos Scientific Lab., N. Mex.). p.75-88 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

Solvent extraction of plutonium from nitric acid solutions with tri-n-butyl phosphate in kerosene is an important purification method in the recovery and preparation of plutonium metal. The distribution coefficients of impurities frequently encountered in plutonium were measured at various nitric acid and aluminum nitrate salting agent concentrations. By properly adjusting the nitric acid and aluminum nitrate concentrations, good separation of chromium, nickel, copper, iron, and cerium is attainable in a single extraction cycle. Separation of zirconium, thorium, and uranium are unsatisfactory over the range of process variables studied. (auth)

21595

REMOVAL OF FISSION PRODUCT ELEMENTS FROM PLUTONIUM BY LIQUATION. L. J. Mullins, J. A. Leary, and K. W. R. Johnson (Los Alamos Scientific Lab., N. Mex.). p.101-8 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

Six classes of fission products are listed and pyrometallurgical methods are indicated for removing them (to the extent required) from molten plutonium-rich fuels. Investigations on the removal of refractory and noble metals from plutonium-iron-fissium alloys by liquation are reported. It is concluded that continuous filtration of a portion of the fuel, coupled with halide slagging, should remove most fission products from the molten fuel and permit operation to a satisfactory burn-up level (perhaps 10%). (auth)

21596

RECOVERY OF PLUTONIUM. (to United Kingdom Atomic Energy Authority). British Patent 839,191. June 29, 1960.

A process is presented for the separation of Pu and U from fission products. The process consists of precipitating the Pu and U from solution in their higher oxidation state as an alkali metal plutonyl acetate and alkali metal uranyl acetate. (W.L.H.)

21597

A FLUORIDE VOLATILITY PROCESS FOR THE RECOVERY OF URANIUM. (to United Kingdom Atomic Energy Authority). British Patent 840,311. July 6, 1960.

A fluoride volatility process is described for the recovery of uranium from neutron-irradiated uranium. The process consists of treating the neutron-irradiated uranium with a halogen fluoride in the liquid phase, fractionally distilling the liquid phase, and separately collecting the UF_6-rich fraction. (W.L.H.)

21598

METHOD FOR THE SEPARATION OF PLUTONIUM FROM URANIUM. Erik Axel Haeffner and Åke Valdemar Hultgren (to Aktiebolaget Atomenergi). British Patent 841,602. July 20, 1960.

A method is presented for the separation of Pu from U by means of a single step after primary extraction of these elements with an organic solvent. The solution containing the dissolved Pu and U is passed through a column containing a comminuted solid absorption material on which is absorbed a solvent capable of dissolving the Pu compounds. After passage of the solution the Pu is eluted with a solvent dissolving the Pu from the absorbed solution. (W.L.H.)

21599

IMPROVEMENTS IN OR RELATING TO NUCLEAR FUEL PROCESSING. Jack Williams and William James Keith Wright (to United Kingdom Atomic Energy Authority). British Patent 841,860. July 20, 1960.

A process is described for the recovery of fertile oxide materials from dispersion fuel elements consisting predominantly of iron. The process consists of melting the

element in an inert atmosphere and maintaining the metal in a molten state while the oxide collects on the surface of the molten metal. The oxide is mechanically separated from the surface of the molten metal. (W.L.H.)

21600

SEPARATION OF PLUTONIUM. (to United Kingdom Atomic Energy Authority). British Patent 842,591. July 27, 1960.

A process is described for the separation of Pu from U and fission products. The Pu is separated in its reduced state with bismuth phosphate. The bismuth phosphate is formed by adding a solution of bismuth ions which is between 5 and 10 N in HNO_3 to the Pu solution which contains phosphate ions. (W.L.H.)

21601

SEPARATION OF STRONTIUM FROM OTHER FISSION PRODUCTS. (to United Kingdom Atomic Energy Authority). French Patent 1,185,092. Feb. 9, 1959.

Substantially pure radioactive $Sr(NO_3)_2$ is isolated from aqueous solutions containing fission products and Al by heating the solution to 50 to 75°C, adding concentrated HNO_3 until the HNO_3 concentration in the solution is 18 molar at least, maintaining the elevated temperature during 12 hr at least, and separating the precipitate.

21602

METHOD AND APPARATUS FOR RECOVERING GASEOUS FISSION PRODUCTS FROM REACTOR FUELS. (to Deutsche Gold- und Silber-Scheideanstalt vormals Roessler). French Patent 1,187,006. Mar. 2, 1959.

Gaseous fission products are continuously removed from nuclear fuel elements by flushing them with an inert gas (He, Ne, Ar), which in gas-cooled reactors may be the same as the coolant gas. Canned fuel elements are provided with an inlet and an outlet for the gas; the fissile material should then be porous, contain channels, or consist of small molded objects. The method is particularly useful with gas-cooled reactors having uncanned fuel elements, such as porous molded objects consisting of oxides, nitrides, carbides, or silicides.

21603

ELIMINATION OF FISSION PRODUCTS FROM NUCLEAR REACTORS. (to C. A. Parsons and Co., Ltd.). French Patent 1,187,385. Mar. 2, 1959.

A method is described for removing fission products from liquid metal fuel reactors. The fuel flows upwards by convection through a vertical tube extending from a high-flux reactor core region into an evacuated header, from whence it returns to the core. In the header the fuel presents a free surface. The flow in the tube outside the core is sufficiently small to ensure that the nuclear fission causes boiling of the fuel in the tube and at the free surface, whereby gaseous fission products are removed together with iodine formed by dissociation of metal iodides, and other impurities more volatile than the fuel (e.g., Po from a Bi fuel). The volatile products are eliminated from the header.

21604

TREATMENT OF RESIDUAL RADIOACTIVE SOLUTIONS. (to U. S. Atomic Energy Commission). French Patent 1,188,033. Mar. 9, 1959.

A method is described for drying radioactive aqueous solutions, e.g., nitric acid solutions resulting from the solvent extraction treatment of U–Al alloys. The solution is vaporized into a heated bed, e.g., Al_2O_3 granules (grain size 0.8 to 0.07 mm), fluidized by air and afterwards by steam. The dissolved salts are thereby transformed into oxides which are removed from the reaction chamber and stored; Sr^{90} and Cs^{137} may be recovered from these oxides. The gases resulting from the evaporation are filtered, freed from condensible matter, and discharged into the atmosphere. The evaporation and calcination are performed at 320 to 550°C; at 500°C the tendency of the granules to grow is minimal.

21605

TREATMENT OF NUCLEAR FUEL. (to United Kingdom Atomic Energy Authority). French Patent 1,188,891. Mar. 16, 1959.

An irradiated fissile metal (U or Pu) is introduced into a molten bath of $PbCl_2$ and an alkaline metal chloride until the Pb is nearly completely replaced and the fissile metal is in excess. The bath is separated, and Al or Mg is introduced until the fissile metal is nearly completely replaced. The fissile metal separated from the bath is free from the greater part of the fission products. A further decontamination may be obtained by heating the separated fissile metal above its melting point.

21606

PROCESS FOR RECOVERING NUCLEAR FUEL FROM USED FUEL ELEMENTS. (to Carborundum Co.). French Patent 1,196,066. May 25, 1959.

A method is given for reprocessing Zr or Zircalloy canned U–Zr alloy fuel. The can is removed by dissolving in a neutral 10 to 50% NH_4F solution at a temperature between 25°C and the boiling point. Can residues are mechanically removed after which the fuel core is dissolved in a fresh NH_4F bath, resulting in a solution containing U and Zr and a precipitate containing fission products and Pu. After separation from the precipitate and addition of solid NH_4F, the solution is cooled; a green precipitate consisting of $U–Zr–NH_4–F$ crystals is formed which is separated and dispersed in water. $(NH_4)_3ZrF_7$ dissolves whereas UF_4 remains insoluble and can be separated and transformed into substantially pure U_3O_8. The precipitate containing fission products and Pu is likewise dispersed in water and moderately oxidized; oxalic acid is added and the precipitate separated. Pu can be recovered from the solution. The waste solutions which are obtained during the process, containing mainly NH_4F and $(NH_4)_3ZrF_7$, are treated with NH_3 to precipitate $Zr(OH)_4$; the filtrate is freed from NH_3 and returned in the process. A variant of the process comprises the application of NH_4HF_2 instead of NH_4F.

21607

METHOD FOR TREATING NUCLEAR FUEL. (to United Kingdom Atomic Energy Authority). French Patent 1,196,550. May 25, 1959.

Irradiated fuel is dissolved in nitric acid, the acidity adjusted to 1 to 5 M, the solution treated with nitrous acid at 50 to 80°C during 1 hr, cooled, and extracted with diluted TBP. The TBP phase obtained is purified with 1 to 5 M nitric acid. The nitrous acid treatment greatly increases the ruthenium decontamination factor.

21608

PROCESS FOR SEPARATING PLUTONIUM FROM URANIUM. (to Aktiebolaget Atomenergi). French Patent 1,200,807. July 6, 1959.

A partition separation method is described in which a solution of U and Pu nitrate in an organic solvent (e.g., dibutylcarbitol, optionally diluted with hydrocarbons) is sent through a column containing a finely divided carrier (e.g., silica gel) which has adsorbed a second solvent that is substantially immiscible with the first one and preferentially

dissolves the Pu compound. After passage of the organic solvent the column is washed out with the organic solvent containing 0.34 M HNO_3 to remove U and finally eluted with the organic solvent containing 1.15 M HNO_3 to recover Pu. The first Pu fractions are practically free of fission products. Other solvents and carriers may be used.

21609

PROCESS FOR SEPARATING PLUTONIUM BY REPEATED PRECIPITATION WITH AMPHOTERIC HYDROXIDE CARRIERS. B. F. Faris (to U. S. Atomic Energy Commission). U. S. Patent 2,931,701. Apr. 5, 1960.

A multiple carrier precipitation method is described for separating and recovering plutonium from an aqueous solution. The hydroxide of an amphoteric metal is precipitated in an aqueous plutonium-containing solution. This precipitate, which carries plutonium, is then separated from the supernatant liquid and dissolved in an aqueous hydroxide solution, forming a second plutonium-containing solution. Ions of an amphoteric metal which forms an insoluble hydroxide under the conditions existing in this second solution are added to the second solution. The precipitate which forms and which carries plutonium is separated from the supernatant liquid. Amphoteric metals which may be employed are aluminum, bismuth, copper, cobalt, iron, lanthanum, nickel, and zirconium.

21610

REGENERATION OF REACTOR FUEL ELEMENTS. W. L. Lyon (to U. S. Atomic Energy Commission). U. S. Patent 2,931,721. Apr. 5, 1960.

A process is described for concentrating uranium and/or plutonium metal in aluminum alloys in which the actinide content was partially consumed by neutron bombardment. Two embodiments are claimed: Either the alloy is heated, together with zinc chloride to at least 1000°C whereby some aluminum, in the form of aluminum chloride, and any zinc formed volatilize; or else aluminum fluoride is added and reacted at 800 to 1000°C and subatmospheric pressure whereby part of the aluminum volatilizes as aluminum subfluoride.

21611

CONCENTRATION OF Pu USING OXALATE TYPE CARRIER. D. M. Ritter and R. P. S. Black (to U. S. Atomic Energy Commission). U. S. Patent 2,933,369. Apr. 19, 1960.

A method is given for dissolving and reprecipitating an oxalate carrier precipitate in a carrier precipitation process for separating and recovering plutonium from an aqueous solution. Uranous oxalate, together with plutonium being carried thereby, is dissolved in an aqueous alkaline solution. Suitable alkaline reagents are the carbonates and oxalates of the alkali metals and ammonium. An oxidizing agent selected from hydroxylamine and hydrogen peroxide is then added to the alkaline solution, thereby oxidizing uranium to the hexavalent state. The resulting solution is then acidified and a source of uranous ions provided in the acidified solution, thereby forming a second plutonium-carrying uranous oxalate precipitate.

21612

PRECIPITATION METHOD FOR THE SEPARATION OF PLUTONIUM AND RARE EARTHS. S. G. Thompson (to U. S. Atomic Energy Commission). U. S. Patent 2,934,402 Apr. 26, 1960.

A method of purifying plutonium is given. Tetravalent plutonium is precipitated with thorium pyrophosphate, the plutonium is oxidized to the tetravalent state, and then impurities are precipitated with thorium pyrophosphate.

21613

RECOVERY OF AMERICIUM. M. Ader and H. H. Hyman (to U. S. Atomic Energy Commission). U. S. Patent 2,934,403. Apr. 26, 1960.

A process is given for separating americium and plutonium and recovering the americium. Plutonium is extracted from a solution containing plutonium and americium with a water-insoluble solvent, and americium is precipitated from the aqueous phase by adding a ferric salt and an alkali metal hydroxide thereto. The precipitate may then be dissolved in hydrochloric acid and the ferric salt extracted from the americium with an organic solvent.

21614

SCAVENGER AND PROCESS OF SCAVENGING. C. M. Olson (to U. S. Atomic Energy Commission). U. S. Patent 2,934,404. Apr. 26, 1960.

Carrier precipitation processes are given for the separation and recovery of plutonium from aqueous acidic solutions containing plutonium and fission products. Bismuth phosphate is precipitated in the acidic solution while plutonium is maintained in the hexavalent oxidation state. Preformed, uncalcined, granular titanium dioxide is then added to the solution and the fission product-carrying bismuth phosphate and titanium dioxide are separated from the resulting mixture. Fluosilicic acid, which dissolves any remaining titanium dioxide particles, is then added to the purified plutonium-containing solution.

21615

METHOD FOR PURIFYING URANIUM. J. B. Knighton and H. M. Feder (to U. S. Atomic Energy Commission). U. S. Patent 2,934,425. Apr. 26, 1960.

A process is given for purifying a uranium-base nuclear material. The nuclear material is dissolved in zinc or a zinc-magnesium alloy and the concentration of magnesium is increased until uranium precipitates.

21616

RARE-EARTH METAL FISSION PRODUCTS FROM LIQUID U–Bi. R. H. Wiswall (to U. S. Atomic Energy Commission). U. S. Patent 2,936,231. May 10, 1960.

Fission product metals can be removed from solution in liquid bismuth without removal of an appreciable quantity of uranium by contacting the liquid metal solution with fused halides, as for example, the halides of sodium, potassium, and lithium and by adding to the contacted phases a quantity of a halide which is unstable relative to the halides of the fission products, a specific unstable halide being $MgCl_2$.

21617

FISSION PRODUCT REMOVAL FROM ORGANIC SOLUTIONS. R. H. Moore (to U. S. Atomic Energy Commission). U. S. Patent 2,936,318. May 10, 1960.

The decontamination of organic solvents from fission products and in particular the treatment of solvents that were used for the extraction of uranium and/or plutonium from aqueous acid solutions of neutron-irradiated uranium are treated. The process broadly comprises heating manganese carbonate in air to a temperature of between 300 and 500°C whereby manganese dioxide is formed; mixing the manganese dioxide with the fission product-containing organic solvent to be treated whereby the fission products are precipitated on the manganese dioxide; and separating the fission product-containing manganese dioxide from the solvent.

21618

SEPARATION OF PLUTONIUM FROM FISSION PRODUCTS BY A COLLOID REMOVAL PROCESS. J. Schubert (to

U. S. Atomic Energy Commission). U. S. Patent 2,937,924. May 24, 1960.

A method is given for separating plutonium from uranium fission products. An acidic aqueous solution containing plutonium and uranium fission products is subjected to a process for separating ionic values from colloidal matter suspended therein while the pH of the solution is maintained between 0 and 4. Certain of the fission products, and in particular, zirconium, niobium, lanthanum, and barium are in a colloidal state within this pH range, while plutonium remains in an ionic form. Dialysis, ultracentrifugation, and ultrafiltration are suitable methods of separating plutonium ions from the colloids.

21619

SOLVENT EXTRACTION PROCESS FOR URANIUM FROM CHLORIDE SOLUTIONS. C. A. Blake, Jr., K. B. Brown, and D. E. Horner (to U. S. Atomic Energy Commission). U. S. Patent 2,937,925. May 24, 1960.

An improvement was made in a uranium extraction process wherein the organic extractant is a phosphine oxide. An aqueous solution containing phosphate ions or sulfate ions together with uranium is provided with a source of chloride ions during the extraction step. The presence of the chloride ions enables a phosphine oxide to extract uranium in the presence of strong uranium-complexing ions such as phosphate or sulfate ions.

21620

METHOD OF SEPARATING Pu FROM METATHESIZED $BiPO_4$ CARRIER. W. J. Knox and S. G. Thompson (to U. S. Atomic Energy Commission). U. S. Patent 2,938,768. May 31, 1960.

A process is given for separating uranium, neptunium, and/or plutonium from a bismuth hydroxide carrier by selective dissolution of these actinides with nitric acid of a concentration of from 0.05 to 0.5N.

21621

SEPARATION OF HAFNIUM FROM ZIRCONIUM. L. B. Overholser, C. J. Barton, Sr., and J. W. Ramsey (to U. S. Atomic Energy Commission). U. S. Patent 2,938,769. May 31, 1960.

The separation of hafnium impurities from zirconium can be accomplished by means of organic solvent extraction. The hafnium-containing zirconium feed material is dissolved in an aqueous chloride solution and the resulting solution is contacted with an organic hexone phase, with at least one of the phases containing thiocyanate. The hafnium is extracted into the organic phase while zirconium remains in the aqueous phase. Further recovery of zirconium is effected by stripping the organic phase with a hydrochloric acid solution and commingling the resulting strip solution with the aqueous feed solution. Hexone is recovered and recycled by means of scrubbing the organic phase with a sulfuric acid solution to remove the hafnium, and thiocyanate is recovered and recycled by means of neutralizing the effluent streams to obtain ammonium thiocyanate.

ENGINEERING AND EQUIPMENT

General and Miscellaneous

21622 CF-60-6-105

Oak Ridge National Lab., Tenn.

TEST OF HRT-CP MULTICLONE NO. 1 FOLLOWING REMOVAL FROM REACTOR CELL. O. O. Yarbro. June 28, 1960. 10p. Contract [W-7405-eng-26]. OTS.

The multiple hydroclone unit, or multiclone, installed in the reactor cell prior to run 20, in an effort to increase the solids removal rate of the hydroclone system, was removed after 4500 hr of operation (end of HRT run 21). Examination and tests of this unit after removal indicated an accumulation of about 100 g of solids in the feed chamber and partial plugging of one to three hydroclone feed ports. The plugged hydroclones would permit flow from the underflow pot to the overflow stream and continuously flush solids from the underflow pot. This flow would probably reduce the efficiency of the multiclone unit to zero in the induced underflow condition and significantly reduce the efficiency with the cell "C" hydroclone on stream. (auth)

21623 DP-482

Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.

PARALLEL OPERATION OF WELDING GENERATORS. Benjamin H. Butler. June 1960. 11p. Contract AT(07-2)-1. OTS.

Eight 900-amp, 36-kw direct current welding generators driven by eight 60-hp induction motors were operated in parallel to supply up to 7200 amp to resistance loads for heat transfer studies. A description and circuit designs of this installation, which provides safety interlocks and permits sectionalized operation for separate loads, are given. (auth)

21624 NAA-SR-Memo-4268

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

STRESS RELIEVING FITTING—STRESS EVALUATION. W. F. Anderson. Aug. 18, 1959. 6p. OTS.

A stress analysis was performed for the most critical area of a stress relieving joint of the Sodium Reactor Experiment, the area of the weld between the line and the weld-o-let fitting. Damage factors were determined for all modes of operation. (C.J.G.)

21625 NP-8876

Wyandotte Chemicals Corp., Wyandotte, Mich.

THE SYNTHESIS AND EVALUATION OF NEW BASE STOCK FLUIDS FOR GAS TURBINE APPLICATION. Quarterly Progress Report No. 3 Covering Period March 1, 1960 to May 31, 1960. John D. Behun, Peter T. Kan, Saiyid M. Naqvi, and Patricia A. Gibson. June 1, 1960. 99p. Project No. 9(2-3044); Contract No. AF-33(616)-6749.

Progress is reported on the synthesis of new pyrazine derivatives for evaluation as gas turbine lubricants. The preparation of a variety of pyrazine containing intermediates and their subsequent conversion to further modified derivatives is described. Some physical properties of these materials are discussed. Various classes of 2-substituted-3-methylpyrazines in which the substituents are phenoxy, mercapto, anilino, and silyl radicals were extended to include new members of each class. Studies on the phenylation and acylation of these intermediates at the methyl site were continued, and examination of the intermediates oxidation at this position was initiated. Reactions were conducted using model compounds to determine the feasibility of preparing pyrazine derivatives with new types of linkages. An attempt to prepare di[2-(3-methylpyrazyl)] ether gave the isomeric compound N-[2-(3-methylpyrazyl)]-3-methyl-2-pyrazone instead. Methylpyrazine was converted to phenoxybenzylpyrazine by a "benzyne" type reaction. The previously prepared α,α-difluorophenacylpyrazine was converted to 1-phenyl-2-pyrazyltetrafluoroethane with the aid of sulfur tetrafluoride. An ultraviolet spectral study of 2-anilino-3-methylpyrazines and related reference compounds suggests that these intermediates tend to exist in

the intact pyrazine structure rather than the tautomeric amidine form. The observed general good thermal stability of these materials supports the conclusions from the U.V. study. The thermal stability screening of 2-substituted-3-methylpyrazines and other pyrazine derivatives was continued. Previously observed trends seem to be reinforced by the more recent data. Two compounds displayed noteworthy stability, viz., 2-(p-nonylphenoxy)-3-methylpyrazine and 2-(p-dodecylphenoxy)-3-methylpyrazine gave no detectable viscosity change after being subjected to the test (500°F for 9 hours). Some 2-mercapto-3-methylpyrazines were found to be very unstable. A difference in the mode of thermal decomposition of the alkyl- and the arylmercaptopyrazines was established. Some preliminary attempts are made to correlate the physical properties of the various pyrazine derivatives with their structures. (For preceding period see NP-8514.) (J.R.D.)

21626 Y-1304

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn. AIR LIFT PUMPS--CHARACTERISTICS AND APPLICATION TO LIQUID-LIQUID EXTRACTION SYSTEMS. J. S. Hurst. May 24, 1960. 23p. Contract W-7405-eng-26. OTS.

Operating characteristics and design considerations of air lift pumps, consisting of pipe sections 20 feet long, are presented for standard pipe sizes of 0.125 through 2 inches. The application of air lift pumps to liquid-liquid extraction systems and an instrumentation system for control purposes are described. (auth)

21627 SCL-T-313

CONTRIBUTION TO THE STUDY OF BRUSHES AND OF THE SLIDING CONTACTS. (Contribution à l'Étude des Balais et du Contact Glissant). (Excerpts). J. Millet. Translated by Marcel I. Weinreich (Sandia Corp.) from Bull. soc. franc. electriciens (7) 7, 574-83(1957). 13p. JCL.

In the study of sliding contact of a graphite brush on copper in a rarefied atmosphere the following were investigated: abrasion and friction, atmospheric action, remedies for friction and abnormal abrasion, and passage of current. (W.L.H.)

21628

INFLUENCE COEFFICIENTS AND PRESSURE VESSEL ANALYSIS. G. D. Galletly (Shell Development Co., Emeryville, Calif.). J. Eng. Ind. 82, 259-69(1960) Aug.

A description is given of the utility of influence coefficients for analyzing pressure vessels. To illustrate their advantages two relatively complex problems were selected and their final stress distributions calculated. The problems were (i) a cylinder closed by a torispherical head and (ii) a cylinder joined to a smaller cylinder by an ellipsoidal-toroidal shell. Two vessels were analyzed using influence coefficients which were recently made available. It is shown that accurate stress distributions can be obtained quickly and that a specialized knowledge of shell theory is not required. The method shows the distribution of bending stresses throughout the shells. These latter, which can be important, are usually ignored by the various codes. (auth)

21629

PROBLEMS REGARDING THE CONSTRUCTION OF UP-TO-DATE OIL DIFFUSION PUMPS AND DESCRIPTION OF THE PUMPS MADE AT THIS INSTITUTE. István Berecz. Magyar Tudományos Akad. Atommag Kutató Intézete (Debrecen), Közlemenyek 1, 51-64(1959). (In Hungarian)

A summary is presented of the present state of theoretical and technical problems regarding oil diffusion pumps and the principles of their development. Oil diffusion pumps of the fractional type are discussed as most preferable for nuclear research. The fractionating-type oil diffusion pumps and a high-vacuum valve constructed by the Institute of Nuclear Research of the Hung. Acad. Sci. are described. (auth)

21630

A METALLIC APPARATUS FOR RESEARCH IN ULTRA-HIGH VACUUM. Horst Ehlers and Justus Moll (Leybold-Hochvakuum-Anlagen G.m.b.H., Cologne). Z. angew. Phys. 12, 324-8(1960) July. (In German)

A method is described in which ultrahigh vacuum can be produced in a metallic chamber. The construction principle for the apparatus can be varied easily for numerous research problems. Practical results on the investigations which can be carried out with laboratory apparatus are reported. The time between sealing the chamber at atmospheric pressure and the attainment of a pressure in the region of 10^{-9} Torr is about 4 hr. (tr-auth)

21631

ADVANCES IN VACUUM SCIENCE AND TECHNOLOGY. PROCEEDINGS OF THE FIRST INTERNATIONAL CONGRESS ON VACUUM TECHNIQUES, 10-13 JUNE 1958, NAMUR, BELGIUM. E. Thomas, ed. VOLUME I. FUNDAMENTAL PROBLEMS IN VACUUM TECHNIQUES, ULTRA-HIGH VACUUM. VOLUME II. VACUUM SYSTEMS APPLICATIONS IN VARIOUS SCIENCES AND TECHNIQUES. New York, Pergamon Press, 1960. 868p. $30.00. (In English, French, and German)

The proceedings of the First International Congress on Vacuum Techniques held at Namur, Belgium, 10-13 June, 1958, are presented. Volume one contains general papers on vacuum techniques, and sections entitled: mechanical pumps, diffusion pumps and ejectors, leak detection vacuum measurement, pumping speed measurement, leads and connections, and ultra-high vacuums. Volume two contains general papers on vacuum system uses in science and technology. Separate abstracts have been prepared for 22 of the papers. (T.R.H.)

21632

EVAPOR-ION PUMP DEVELOPMENT AT THE UNIVERSITY OF WISCONSIN. R. G. Herb (Univ. of Wisconsin, Madison). p.45-55 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In English)

Evapor-ion pumps have been developed at the University of Wisconsin for a variety of applications. The largest of these pumps has a diameter of 24 in. It is used in connection with a hydrogen negative ion source and gives a pumping speed for hydrogen of approximately 15,000 l/s at pressures in the region of 5×10^{-6} mmHg. Several pumps of 12 in. diam. and of 8 in. diam. are now being used. For other applications pumps of 1 in. diam. and 2 in. diam. have been developed. Evaporation techniques, starting techniques, and general operational characteristics of these pumps are given. (auth)

21633

THE APPLICATION OF HIGH VACUUM TECHNIQUES FOR REACTOR MATERIALS. Heimo Hardung-Hardung (Deutsche Gold- und Silber-Scheideanstalt A. G., Frankfurt am Main). p.59-62 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress

on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In English)

The high purity standards for the manufacture and fabrication of reactor materials and the particular qualities of some reactor metals necessitate unusual characteristics at the vacuum apparatus used in some process stages. For the melting and casting of reactor metals, special induction- and arc-furnaces are being used. Vacuum sublimation of reactor metals requires careful consideration of the vapor pressure curves of parasitic impurities by the apparatus builder. Sintering of reactor materials has to take care of the possibilities of contamination by filament evaporation as well as unusual temperature constancy conditions. For chemical reactions serving the manufacture of reactor materials, special furnaces are being used which in view of the high temperatures in the furnace interior often require relief vacuum. (auth)

21634

HIGH-VACUUM PUMPS AND UNITS FOR ACCELERATORS. S. A. Vekshinskiĭ (Vekshinsky), M. I. Menshikov, and I. S. Rabinovich. p.63-8 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In English)

A description is given of the devices used in vacuum pumps for accelerators in the USSR to prevent vapor migration into the vacuum chamber. A ring device is used to speed up oil fractionation in the 380 mm 5000 l/sec pump. An oil-catching device is also described which has a cone cap with a water cooling pipe. The cap covers the upper nozzle on the pump. Liquid-N_2 cold traps are described and discussed. (T.R.H.)

21635

IMPROVEMENTS IN HOIST SYSTEMS FOR HANDLING ARTICLES INSIDE A FLUIDTIGHT CHAMBER. Laurent Urbain Chanut and Gabriel Roger Dardy (to Commissariat à l'Énergie Atomique). British Patent 833,831. May 4, 1960.

A system for handling heavy containers of radioactive materials in a fluid-tight chamber was invented and consists of a traveling crane on a bridge mounted above the floor. This system is intended to operate in chambers with vertical sockets provided in the floor for holding containers. (D.L.C.)

21636

IMPROVEMENTS IN PRESSURE VESSELS. James Playford Duncan and Noel William Murray (to John Thompson Water Tube Boilers Ltd.). British Patent 836,739. June 9, 1960.

A design is presented for increasing the size of pressure vessels and to enable their shapes to be readily designed for their given purpose when the wall thickness must not exceed an economical maximum. The pressure vessel has a corrugated wall consisting of curved shell members forming substantially the whole of the surface of the wall. Every shell member is discontinuous at, and secured to, a rib of a supporting structure along each junction of the shell members. In this way the supporting structure supports the bending stresses in the vessel caused by the weight of the vessel. (W.L.H.)

21637

IMPROVEMENTS IN OR RELATING TO REMOTE CONTROL EQUIPMENT FOR TRANSMITTING ROTARY MOTION. Reginald Case-Newton and Arthur James Howarth (to United Kingdom Atomic Energy Authority). British Patent 837,734. June 15, 1960.

A remote control unit was invented for manipulation of apparatus behind a shielding wall; it comprises a frame supporting a series of rotatable spaced rings and with internal wheels engaging these rings through gaps in the frame. This unit, in conjunction with flexible cables running through the shielding wall, can be used to operate apparatus, e.g., those for colorimetric comparison of solutions. (D.L.C.)

21638

METHOD AND MEANS FOR THE RECOVERY OF HEAT. (to Electricite de France). British Patent 839,125. June 29, 1960.

A method is presented for recovering heat from the fluid that is used to cool the reaction chamber of a nuclear reactor and for producing electrical or mechanical energy from the heat. (W.L.H.)

21639

IMPROVEMENTS IN OR RELATING TO VAPOUR GENERATORS. (to Westinghouse Electric Corp.). British Patent 841,656. July 20, 1960.

The design of a compact vertical steam generator having a minimum size for a given power output is reported. (W.L.H.)

21640

TUBE SHEARING VALVE. L. B. Wilner (to U. S. Atomic Energy Commission). U. S. Patent 2,937,654. May 24, 1960.

Explosive operated valves can be used to join two or more containers in fluid flow relationship, one such container being a sealed reservoir. The valve is most simply disposed by mounting it on the reservoir so that a tube extends from the interior of the reservoir through the valve body, terminating at the bottom of the bore in a closed end; other containers may be similarly connected or may be open connected, as desired. The piston of the valve has a cutting edge at its lower end which shears off the closed tube ends and a recess above the cutting edge to provide a flow channel. Intermixing of the fluid being transferred with the explosion gases is prevented by a copper ring at the top of the piston which is force fitted into the bore at the beginning of the stroke. Although designed to avoid backing up of the piston at pressures up to 10,000 psi in the transferred fluid, proper operation is independent of piston position, once the tube ends were sheared.

Heat Transfer and Fluid Flow

21641 AD-231775

Brown Univ., Providence.

THE STABILITY OF NON-DISSIPATIVE COUETTE FLOW IN THE PRESENCE OF AN AXIAL MAGNETIC FIELD. Technical Report No. 31. W. H. Reid. Jan. 1960. 8p. Contract Nonr-562(07).

The magnetic field strength required to completely stabilize Couette flow is determined. (J.R.D.)

21642 AFOSR-TN-60-64

Minnesota. Univ., Minneapolis. Heat Transfer Lab.

EFFECT OF BUOYANCY FORCES ON MASS TRANSFER COOLING. Technical Report 25. R. Eichhorn. Feb. 1960. 16p. Contract AF18(600)-1226.

The constant property, laminar boundary layer equations

with free convection and mass transfer were considered. Similar solutions were found to be possible for blowing rate distributions varying as the distance from the leading edge, raised to the power $(n - 1/4)$ where n is the exponent in a power law surface temperature distribution. Solutions were obtained for the equations in the form of skin friction and heat transfer parameters. Velocity and temperature profiles were determined for the constant wall temperature case for a fluid with Pr = 0.73. The cases considered ranged from strong suction to strong blowing. Mass transfer had a pronounced effect on the heat transfer but only a slight effect on the skin friction. In light of the solutions presented, these effects were shown to be physically rational. (auth)

21643 AFOSR-TN-60-647

Brown Univ., Providence.

HEAT TRANSFER FROM SURFACES OF NON-UNIFORM TEMPERATURE DISTRIBUTION. PART II. TURBULENT TRANSFER FROM ISOTHERMAL SPANWISE STRIPS ON A FLAT PLATE. H. H. Sogin and R. J. Goldstein. Feb. 1960. 47p. Project No. 17500. Contract AF49(638)-46. OTS.

Experiments were performed on mass transfer by forced convection from naphthalene strips on a flat plate to an air stream at ordinary temperature and pressure. Turbulence was induced in the boundary layer by means of a wire strip. In all cases there was a hydrodynamic starting length upstream of the strips. The ratio of this inert length to the total length was varied from about 0.80 to 0.96. The flow was practically incompressible with Reynolds number, based on the total length, varying from 175,000 to 486,000. The Schmidt number was 2.5. The experimental results fell in proximity to the Seban step function factor when they were reduced after the mass-momentum analysis of Deissler and Loeffler for a surface of uniform vapor pressure. When Kármán's formulation of the mass-momentum analogy was assumed, the data fell between the values predicted by the Seban and by the Rubesin expression for the step function factor. The results were well correlated by the Colburn analogy in conjunction with the Rubesin step function factor. (auth)

21644 BLG-46

Brussels. Centre d'Étude de l'Énergie Nucléaire.

NOTES SUR QUELQUES PROBLEMES DE THERMIQUE ET D'ECOULEMENT DES FLUIDES EN REGIME LAMINAIRE. (Notes on Some Thermal and Flow Problems of Fluids in the Laminar Region). P. Defrance. Mar. 12, 1959. 16p.

The theory of fluid motion or heat transfer in a so-called laminar flow (or streamline flow) is based on the viscosity equation. This equation enables one to find an exact expression for the fall of pressure or the coefficient of heat exchange in the case of a straight tube of circular cross-section, without frictional resistance at the boundary. For cross-sections which are nearly circular, the formula is usually still applied, using the concept of the "hydraulic diameter." This diameter is defined by D = 4S/B where S is the area of the cross section and B the "wetted perimeter." (S/B is the so-called hydraulic mean depth). This method being an approximative one, it was thought useful to derive the exact expressions for tubes of cross-sections which are sensibly non-circular. First the flow of fluids is treated then the heat transfer: (1) between two parallel plates with a mutual distance that can be neglected with regard to the width of the plates; (2) in a tube of rectangular cross-section; (3) between two concentric tubes of circular cross-section. A brief summary is given of the classical concepts and methods which lead to the formulae of a streamline flow in a tube of circular cross-section. (auth)

21645 HW-60343

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THERMAL CONTACT CONDUCTANCE OF FUEL ELEMENT MATERIALS. Robert G. Wheeler. Apr. 10, 1959. 16p. Contract AT(45-1)-1350. OTS.

Measured thermal contact conductance data for joints between various metallic and non-metallic materials are presented. The apparatus used to obtain thermal contact conductance data in vacuum or gas atmosphere and at high thermal flux levels is described. Application of data obtained to problem of predicting conductance of a joint is discussed. (auth)

21646 JPL-PR-20-279

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

UNSTEADY BOUNDARY-LAYER AND HEAT-TRANSFER PHENOMENA — A LITERATURE SURVEY. Robert S. Wick. Aug. 15, 1955. 26p. ORDCIT Project. Contract DA-04-495-Ord 18.

Experimental and theoretical data on unsteady fluid flow and heat transfer in regions where viscous effects are important are reviewed. Fluid flow is reviewed relative to oscillating flow, flow fluctuations along surfaces as functions of space and time, and unsteady flow in ducts. Heat transfer in ducts, to a flat plate, and to cylinders is discussed. (C.J.G.)

21647 NAA-SR-Memo-4020

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

GENERAL HEAT TRANSFER MECHANISMS SUITABLE FOR USE IN OMR FUEL ELEMENTS. A Literature Survey and Evaluation Study. J. D. Wilde. [195?]. 64p. OTS.

Several methods of improving the rate of heat removal from surfaces cooled by forced convection were studied. Each method was evaluated on the basis of heat transfer capability (Btu/hr °F) per unit horsepower required to pass the coolant across the surface. The method found to be most efficient and practical was the use of extended surface. Of the many types of extended surface, longitudinal and transverse finned surfaces were the most efficient. Transverse fins appeared to be more efficient, particularly as a means of reducing pressure drop. It was recommended that future development effort for forced convection cooled OMR's be focused upon a transverse fin fuel element. (auth)

21648 NP-8908

Stanford Univ., Calif.

HEAT TRANSFER IN ROTATING TURBULENT PIPE FLOW. Technical Report No. 45. D. C. Briggs. Sept. 30, 1959. 61p. Contract Nonr-225(23).

A study devoted to the problem of convection heat transfer between a circular rotating tube and a fluid flowing through the tube is presented. A test apparatus is described and is shown to be adequate for this study. The apparatus includes a variable speed rotating tube which may be either heated or cooled, and an entry length section which may be either rotated or not as desired. Heating and cooling are in both cases at constant surface temperature. Air is employed as a working medium. The results of the first phase of the experimental program are included in this study. The case of gas heating in the turbulent flow Reynolds number range, with a nonrotating entry section, is considered. The test results show that the most important effect of rotation is to delay transition from laminar to

turbulent flow to high through-flow Reynolds numbers. Once fully established turbulent flow is attained, the effect of rotation, at least for the range of variables considered, is small. The convection conductance is increased a few per cent, which evidently represents the effects of the action of the centrifugal field on the density gradient across the flow section. (auth)

21649 NP-8909

Stanford Univ., Calif.

THE HEAT TRANSFER AND FLOW FRICTION CHARACTERISTICS OF AN ELLIPTICAL PIN-FIN HEAT EXCHANGER SURFACE. Technical Report No. 44. W. M. Kays and T. R. Loeschner. Sept. 15, 1959. 26p. Contract Nonr-225(23).

The basic heat transfer and flow friction characteristics of an elliptical pin-fin surface are presented. This surface represents a compromise between a strip-fin surface, where the fins are very thin and lead to low fin effectiveness when high-temperature low-conductivity materials are used, and a circular pin-fin surface, which is attractive for high-temperature applications because of good heat transfer performance coupled with a large fin cross section for conduction, but which has characteristically high friction factors. It is found that performance comparable to that of the best strip-fin surfaces can be obtained, with the further advantage of a larger ratio of fin conduction cross-section area to fin perimeter. The elliptical shape does not eliminate pressure drag, as boundary layer separation still takes place at about the mid-point of the fin. This particular surface geometry does give some difficulty with flow-induced noise, a problem frequently encountered in flow normal to tube banks and in pin-fin heat exchangers. (auth)

21650 NYO-9086

New York Univ., New York. Inst. of Mathematical Sciences.

ON THE KINETIC THEORY OF STEADY GAS FLOWS. Lawrence Sirovich. June 28, 1960. 75p. Contract AT(30-1)-1480. (MF-3). OTS.

An approximate Boltzmann equation, known as the single relaxation model, was studied. This equation was linearized and the fundamental solution considered. Following H. Grad, the solution, asymptotic in small values of the ratio of mean-free-path to distance from the origin, was sought. It was shown that the fundamental solution itself gave the asymptotic description of the flow field past an object. This solution gave the asymptotic description when the distance from the origin was much greater than either the mean-free-path or the body size. This was true independently of the Knudsen number. It was shown that within the linearized framework used, the Navier-Stokes equations gave a consistent asymptotic description of the correct kinetic theory flow field. On the other hand, the inviscid Euler equations failed in the neighborhood of the Mach lines. The asymptotic fundamental solution found gave the fine structure of the wake uniformly in the Mach number. In addition, the solution gave a detailed description of the neighborhood of the Mach line, uniformly in Mach number, as the latter varied from supersonic to high subsonic values. The uniform solution was given in closed form in terms of an Airy function. In the limit of zero mean-free-path, the fundamental solution of the inviscid equations was recovered. Convergence to the inviscid solutions was not uniform. (auth)

21651 PUR-11-M

REGULARITY OF TURBULENT FLOW IN SMOOTH PIPES. J. Nikuradse. Translated by F. W. Bowditch and W. G. Agnew (Purdue Univ.) from Forsch. Gebiete Ingenieurw. B 3, Forschungsheft (1932) Sept.-Oct. 113p.

The regularities of turbulent flow in smooth circular tubes were experimentally investigated for Reynolds' numbers (Re) up to 3240×10^3. The form of the velocity distribution became more full with increasing Re. Good agreement was obtained with the results of Bazin and of Stanton. By forming appropriate dimensionless ratios from the quantities characteristic of the turbulent flow in the vicinity of a wall, a velocity distribution law was derived which is valid in the vicinity of the wall for all Re. The ratio l/r (where l is mixing length and r is tube radius) decreased for each point in the cross section with increasing Re. When Re exceeded 100×10^3, the dimensionless mixing length distribution $l/r = f(y/r)$ became independent of Re. In connection with the Prandtl similarity consideration, an equation was derived for expressing the tube resistance number as a function of Re. Relations between the average velocity $\bar{u}$ and the maximum velocity U were determined. (C.J.G.)

21652

ON HEAT OR MASS TRANSFER BETWEEN THE FLUIDIZING AGENT AND THE SOLID PARTICLES OF THE FLUIDIZED BED. E. Ruckenstein and I. Teoreanu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii ceretări fiz. 11, 117-28(1960). (In Rumanian)

The problem of heat or mass transfer between the fluidizing agent and the solid particles is examined, both in the case of homogeneous fluidization and in that of non-homogeneous fluidization. In the first case the experimental results are correlated, by using the following equations $Nu = 0.426\ Re^{0.30}\ Ar^{0.17}\ Pr^{1/3}$ for $Re\ Ar^{-0.40} < 2.15$ and $Nu = 0.943\ Re^{-1}\ Ar^{0.69}\ Pr^{1/3}$ for $Re\ Ar^{-0.40} > 2.15$, where Nu, Re, Ar, and Pr are Nusselt's, Reynolds', Archimedes', and Prandtl's numbers. Nu, Re, and Ar numbers are computed with the diameter of the particle. In the second case, of non-homogeneous fluidization, the problem of the adequate definition of the transfer coefficient is discussed and the reason why small values are obtained for the transfer coefficients, such as they are defined in the literature, is explained. (auth)

21653

EFFECTS OF INTERNAL HEAT SOURCES ON CONVECTIVE HEAT TRANSFER. E. A. Sidorov. Atomnaya Energ. 9, 51-2(1960) July. (In Russian)

The influence of internal heat sources on convective heat transfer at arbitrary heat fluxes and streamlined surface temperatures was investigated. The results show that the heat evolving source reduces the heat transfer factor and heat absorption increases it. It is also shown that in laminar flow the above effect is more pronounced than in turbulent flow. (R.V.J.)

21654

ROCKET HEAT-TRANSFER LITERATURE. A SIX-PART SURVEY. Thomas F. Irvine, Jr., ed. (North Carolina State Coll., Raleigh). J. Heat Transfer 82, 155-69(1960) Aug.

A survey was made of rocket heat-transfer literature in order to bring together the information from a variety of sources. The survey was divided into six parts: rocket-engine heat sources, rocket cooling techniques, nozzle wall materials, variable fluid-property effects, predictions of thermal properties, and flow separation and acoustic effects. Particular emphasis was placed on advances made in the last decade. (M.C.G.)

21655

UNSTEADY TURBULENT HEAT TRANSFER IN TUBES.

E. M. Sparrow and R. Siegel (National Aeronautics and Space Administration, Lewis Research Center, Cleveland). J. Heat Transfer 82, 170-80(1960) Aug.

An analysis is made of the unsteady turbulent heat transfer in a circular tube whose wall temperature varies arbitrarily with time. The flow is steady and fully developed. The formulation permits the heat-transfer coefficient to vary with time and position in accordance with the energy conservation principle. This is in contrast to previous transient analyses where it was standard to use steady-state, fully developed coefficients. The first step in the analysis yields the heat-transfer response to a step jump in wall temperature, and this is then generalized by a superposition technique to apply to arbitrary time variations. Use of the generalized results is illustrated by application to the case where the wall temperature varies linearly with time. Comparison is made between the unsteady heat-transfer results of the present theory and those computed using steady-state heat-transfer coefficients. (auth)

21656

IMPROVED LUMPED PARAMETER METHOD FOR TRANSIENT HEAT CONDUCTION CALCULATIONS. H. G. Elrod, Jr. (Columbia Univ., New York). J. Heat Transfer 82, 181-8(1960) Aug.

A general mathematical method is presented suitable for the "lumping" of many damped linear systems when the response function and the forcing function can be related by a convolution integral. The method is illustrated by application to transient heat conduction in slabs and cylindrical rods. An ordinary differential equation relating the mean temperature of these bodies to their surface temperature is derived, and then applied to the solution of several problems. Agreement with exact results is found to be excellent except for very rapid transients. Means for estimating error are provided in the paper. (auth)

21657

EXPERIMENTS ON HEAT TRANSFER FROM SPHERES INCLUDING COMBINED NATURAL AND FORCED CONVECTION. T. Yuge (Tōhoku Univ., Sendai, Japan). J. Heat Transfer 82, 214-20(1960) Aug.

Experiments on heat transfer between spheres and air flow were carried out in the range of Reynolds numbers from 3.5 to 1.44×10^5 and Grashof numbers from 1 to 10^5. Empirical formulas for forced, natural, and combined convection are presented and comparison made with other investigations. A graphical procedure, based on experimental results, is used to predict the heat-transfer performance for combined natural and forced convection. (auth)

21658

COMBINED FREE AND FORCED-CONVECTION HEAT-GENERATING LAMINAR FLOW INSIDE VERTICAL PIPES WITH CIRCULAR SECTOR CROSS SECTIONS. Pau-Chang Lu (Case Inst. of Tech., Cleveland). J. Heat Transfer 82, 227-32(1960) Aug.

Combined free and forced-convection effects by heat-generating laminar flow inside cylindrical pipes with elements parallel to the direction of the generating body force were investigated by applying the finite Fourier sine transform and finite Hankel transforms when the cross sections of the pipes were circular sectors. A numerical example is provided to show the effects of various parameters. (auth)

21659

ON COMBINED FREE AND FORCED CONVECTION IN CHANNELS. L. N. Tao (Illinois Inst. of Tech., Chicago). J. Heat Transfer 82, 233-8(1960) Aug.

The heat-transfer problems of combined free and forced convection by a fully developed laminar flow in a vertical channel of constant axial wall temperature gradient with or without heat generations are approached by a new method. By introducing a complex function which is directly related to the velocity and temperature fields, the coupled momentum and energy equations are readily combinable to a Helmholtz wave equation in the complex domain. This greatly reduces the complexities of the problems. For illustrations, the cases of flows between parallel plates and in a rectangular channel are treated. Results show that this method is more direct and powerful than those of previous investigations. (auth)

21660

NEARLY QUASI-STEADY FREE CONVECTION HEAT TRANSFER IN GASES. E. M. Sparrow and J. L. Gregg (National Aeronautics and Space Administration, Lewis Research Center, Cleveland). J. Heat Transfer 82, 258-60 (1960) Aug.

The first-order deviations from the quasi-steady free convection heat transfer conditions were determined and a criterion developed to distinguish when heat transfer is essentially quasi-steady. The system chosen for study was a vertical plate suspended in a gas. The surface temperature was spatially uniform but permitted to take on arbitrary, but continuously differentiable, variations with time. (M.C.G.)

21661

THE EFFECT OF MASS TRANSFER ON FREE CONVECTION. R. Eichhorn (Univ. of Minnesota, Minneapolis). J. Heat Transfer 82, 260-3(1960) Aug.

Consideration is given to the constant property laminar boundary layer equations with free convection and mass transfer. Similar solutions are possible for blowing rate distributions varying as the distance from the leading edge raised to the power $(n-1)/4$ where n is the exponent in a power law surface temperature distribution. Solutions to the equations in the form of skin friction and heat-transfer parameters, and velocity and temperature profiles are presented for the constant wall temperature case for a fluid with Pr = 0.73. The cases considered range from strong suction to strong blowing. Mass transfer has a pronounced effect on the heat transfer but only a slight effect on the skin friction. In light of the solutions presented, these effects are shown to be physically rational. (auth)

21662

IMPROVEMENT TO HEAT EXCHANGE SURFACES. (to C. A. Parsons & Co., Ltd.). French Patent 1,186,785. Feb. 23, 1959.

A cylindrical heat exchange surface is reported, especially of a fuel cartridge of a nuclear reactor, having helical fins and also wider longitudinal fins supported by collars screwed on the ends of the helical fins, the latter serving as screw thread. The helical fins are grooved longitudinally to accommodate the other fins.

Instrumentation

21663 AD-229893

Philco Corp. Lansdale Tube Co. Div., Penna.

NUCLEAR RADIATION RESISTANT POWER TRANSISTORS. Quarterly Progress Report No. 1 [for] May 15 to August 15, 1959. G. F. Watson. 39p. Contract DA-36-039-SC-78307.

A flow sheet for the processing of Ge blanks into surface barrier transistors is presented. A cabinet model jet etcher, employing special illumination techniques, was constructed. Emitter pits of 95 mils diam. and collector pits of 115 mils diam. with flat bottoms and near-vertical sides were etched. The feasibility of forming emitter and collector electrodes by evaporation techniques was studied. Indium electrodes as large as 100 mils diam. were evaporated onto the surface of large unetched diffused blanks. Satisfactory micro alloying was obtained in units heated to 200°C with an In pellet placed on the evaporated electrode. (C.J.G.)

21664 AFCRC-TN-59-640

Dublin Inst. for Advanced Studies. School of Cosmic Physics.

INSTRUCTION FOR USE OF PHOTO-ELECTRIC CONDENSATION NUCLEUS COUNTERS—THEIR CARE AND MAINTENANCE TOGETHER WITH CALIBRATION AND AUXILIARY TABLES. Geophysical Bulletin No. 16. Technical (Scientific) Note No. 6. A. L. Metnieks and L. W. Pollak. Apr. 1959. 43p. Contract AF61(052)-26. (AD-232273).

The principles, design, and operation of photoelectric condensation nucleus counters are discussed. Components of the counters together with care, maintenance, and calibration are described. (C.J.G.)

21665 ARF-1151-6

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

MAGNETIC RECORDER FOR NUCLEAR PULSE APPLICATION. Final Report Covering Period: June 5, 1959 to June 5, 1960. G. M. Burgwald and C. A. Stone. June 27, 1960. 55p. Contract AT(11-1)-702. OTS.

An analog recording technique was investigated in which pulses from a scintillation counter are stretched to a width compatible with the bandwidth of the recorder. Three types of playback systems were considered, i.e., unequalized velocity, equalized velocity, and flux sensitive playback. The results of the three systems were found to be comparable. Loss in resolution in the process was primarily due to nonuniformities in magnetic tape properties and maintenance of an adequate head to tape contact. Instrumental line widths of the order of 3% were achieved using equipment of moderate cost. (For preceding period see ARF-1151-5.) (auth)

21666 ARF-1164-3

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

RESEARCH STUDY ON NEUTRON INTERACTIONS IN MATTER AS RELATED TO IMAGE FORMATION. (Report on Phase I). Period covered: April 1 to July 1, 1960. H. V. Watts and T. Stinchcomb. Aug. 1, 1960. 43p. Contract AT(11-1)-578. OTS.

During phase one of this project the present state of the art of neutron detectors which appears useable for neutron imaging was reviewed. No reports of actual image formation by neutron interactions were found other than that done by J. Thewlis (Brit. J. of App. Phys. 7, 375 (1956)) who used a silver foil activation method of detection. Facts concerning neutron detectors are presented, and considerable insight into the interactions basic to various detection systems which has allowed preliminary predictions as to their usefulness in image formation was obtained. Initial considerations have been made of the effects of scattering upon image quality and of the value of resonance absorption techniques. These considerations have made possible a tentative estimate of the magnitude of these effects. (auth)

21667 BMI-1432

Battelle Memorial Inst., Columbus, Ohio.

DEVELOPMENT OF A FUEL-ELEMENT LEAK-DETECTION SYSTEM BASED ON THE PRINCIPLE OF ISOTOPIC EXCHANGE. James E. Howes, Jr., Thomas S. Elleman, and Duane N. Sunderman. Aug. 1, 1960. 19p. Contract W-7405-eng-92. OTS.

The selective removal of halide fission products from an aqueous solution by exchange with the halide in a solid silver halide was studied as the basis for a fuel-element leak detector. The retention of fission-product halides on a silver halide column was investigated as a function of coolant flow rate, halide anion, and column size. Fission product decontamination factors and predicted operating lifetimes were obtained for a number of reactor operating conditions. It is concluded that a sensitive, rapid leak detector for a water-cooled reactor could be constructed from a silver bromide or iodide column monitored by a neutron detector to detect delayed neutrons from the halide fission products. The feasibility of gross gamma monitoring was found to be dependent upon the intensity of the gamma background arising from absorbed fission products on the silver halide column. (auth)

21668 CEA-1428

France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucleaires, Saclay.

SPECTROGRAPHE γ ENREGISTREUR AVEC ELIMINATION DU BRUIT DE FOND COMPTON. (Recording γ Spectrometer with Elimination of Compton Background). C. Julliot. 1960. 25p.

An instrument derived from the recording γ spectrograph is described which gives better definition of photoelectric peaks by elimination of pulses caused by γ photons incompletely absorbed in the scintillator (Compton effect). This system uses an original method devised by Peirson: the spectrum, devoid of photoelectric peak, supplied by a detector equipped with an anthracene scintillator, is cut off from the spectrum provided by a conventional detector equipped with a NaI (Tl) scintillator. The regulation of the mechanical system, detector support and source allows the detection yields to be adjusted. The electronic system is identical in presentation with that of the recording spectrograph. (auth)

21669 CEA-1440

France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucleaires, Saclay.

ETALONNAGE DES SONDES DE LANGMUIR PAR UNE METHODE HYPERFREQUENCE. (Calibration of Langmuir Probes by a Microwave Method). T. Consoli. 1960. 16p.

Measurements of the electronic density of a plasma between 10^6 and 10^8 e/cm^3 made by the Langmuir probe and by resonance frequency shift of a cavity are compared. (auth)

21670 DP-488

Du Pont de Nemours (E.I.) & Co. Savannah River Lab., Aiken, S. C.

ACCURATE MICROMETER FOR CORROSION SAMPLES. William J. Woodward. June 1960. 11p. Contract AT(07-2)-1. OTS.

A micrometer that utilizes eddy current techniques is described. The gage is capable of measuring nominal 0.5000-in. aluminum rods to an accuracy of ±0.00005 in., and is unaffected by residual nonconductive surface films such as oxides or corrosion products. (auth)

21671 HW-61629

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

EDDY CURRENT ULTRASONIC TRANSDUCER. Hugo L. Libby. Aug. 24, 1959. 15p. OTS.

An eddy current transducer is described which generates and detects ultrasonic vibrations in non-magnetic metals without the use of any coupling medium between the transducer and the metal except free space. The device is useful in measurement of metallic sheet thickness and in measurement of ultrasonic transmission properties of materials. (J.R.D.)

21672 HW-62419

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A SIMPLE TELEPHONE TELEMETER. C. A. Ratcliffe. Nov. 2, 1959. 8p. Contract AT(45-1)-1350. OTS.

A telephone telemeter is described which will answer the telephone ringing signal after three rings, keep the line for a preset length of time, and then release the line. The device is useful for monitoring unattended equipment. (J.R.D.)

21673 HW-64698

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TRANSISTOR PRE-AMPLIFIER FOR NEUTRON MONITORS. P. R. Kelly. Apr. 20, 1960. 16p. OTS.

The design and performance of several transistor impedance matching circuits are discussed. The most satisfactory circuit is capable of operation up to 80°C and was tested to 100°C. The pre-amplifier which is potted with silicone rubber and attached to a waterproof BF_3 tube, may be operated while submerged in water. Acid atmospheres will require some means of protecting the metal surfaces of the pre-amp and BF_3 tube. (auth)

21674 HW-64892

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A WRIST BADGE FILM DOSIMETER FOR HAND DOSE MEASUREMENT. P. E. Bramson. June 7, 1960. 16p. Contract AT(45-1)-1350. OTS.

A description of a wrist film badge dosimeter which employs Cd and Sn shields is given. Data on the response of the dosimeter to several types and energies of radiation are presented. A dose of 5 mrem of slow neutrons is detectable. (C.J.G.)

21675 KAPL-M-GBG-10

Knolls Atomic Power Lab., Schenectady, N. Y.

A COUNTER ARRANGEMENT TO FACILITATE THE AVERAGING OF RADIOACTIVITY ISSUING FROM LONG PLATE OR STRIP LIKE ELEMENTS. G. B. Gavin, M. Murphy, and L. S. Ring. Feb. 3, 1960. Changed from OFFICIAL USE ONLY May 3, 1960. 17p. Contract W-31-109-Eng-52. OTS.

A counting facility was devised to implement the counting of irradiated fuel plates under the high-temperature and high-pressure operating conditions of the Pressurized Test Reactor. With the facility, an entire plate or group of plates can be counted in time intervals of the order of one minute. (C.J.G.)

21676 NP-8814(p.24-5)

Naval Research Lab., Washington, D. C.

TWO-SECTION PULSE FORMERS. D. dePackh.

A two-section pulse former is illustrated and pulse flatness is discussed. Amplitude and frequency conditions, pulse length, and maximum current are derived. (W.D.M.)

21677 NRL-5472

Naval Research Lab., Washington, D. C.

AN IMPROVED DC CURRENT-INTERRUPTER UNIT. C. H. Presbrey, Jr. and S. Schuldiner. Feb. 26, 1960. 21p.

An improved design for a d-c current interrupter was developed. This improvement was made in an effort to remedy certain operational difficulties encountered in the use of an existing model, and to provide for further studies at higher cell-current levels. In its present application to electrochemical studies, the current interrupter is part of an over-all system consisting of the interrupter, a cell-current d-c meter, a cell (with probe), an external power supply for the cell and for gating-stage bias, a peak-to-peak a-c voltmeter, and an oscilloscope for visual or photographic analysis of the interrupted waveform. The specifications of the improved interrupter include features such as current range from 10 μamp to 400 ma, pulse repetition rate from 1 cycle to 10 kc, pulse length from 1 μsec to 0.1 sec, and pulse rise-and-fall time of 0.25 μsec. This unit was used in the study of the time vs. potential characteristics of electrochemical solution IR drops and out of the cleanliness of the associated electrode metals. (auth)

21678 NYO-2656

Evans Research and Development Corp., New York.

THE DEVELOPMENT OF A BETA-RAY PARTICLE SIZE ANALYZER. A NEW INSTRUMENTAL TECHNIQUE FOR AUTOMATIC PARTICLE SIZE ANALYSIS. S. Z. Lewin and Jane Connor. Quarterly Technical Status Report for the Period January 15—April 15, 1960. 26p. Contract AT(30-1)-2372. OTS.

The theory, reliability, and instrumentation employed for particle size analysis by fractionation, discrete counting, and integral property techniques are reviewed. A differential-integral technique is introduced which is based upon measurements of the relative spread in replicate determinations of scattered radiation intensity as a function of viewing aperture diameter. It is shown that radiation from light to beta particles may be utilized. The theory of the technique was verified by measurements of back-scattering intensity of C^{14} beta particles from monosized lead spheres under conditions of the theory. (See also NYO-2654.) (C.J.G.)

21679 ORNL-1694

Oak Ridge National Lab., Tenn.

INSTRUMENTATION AND CONTROLS DIVISION SEMI-ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1953. June 1, 1954. Decl. Mar. 2, 1960. 34p. Contract W-7405-eng-26. OTS.

The sensitivity of techniques for the monitoring of liquid interface levels by bubbling air through dip tubes is improved by the use of a modified Taylor 206 transmitter. A method is proposed for level measurement by electrical capacity techniques. Associated pulse amplitude and monitoring circuits are also described. An orifice-type flowmeter was designed for the measurement of highly radioactive fluids, incorporating a dip tube for liquid head or back-pressure recording. A continuously standardizing precision potentiometer was developed as a versatile source of voltage for control and recording of transduced quantities. Water in PDA flow solutions is detected by a color comparator circuit which monitors the decolorization of permanganate by the C_2H_2 liberated from a water-CaC_2 reaction. Circuits are presented for an improved linear count-rate meter, a preamplifier for electron-attachment studies, and an a-c operated feedback electrometer. Performance curves were obtained for a $B^{10}F_3$ proportional counter of small effective volume. The counter described has an effective volume of 1.2 cc, filled with BF_3 at 15 psig, with a calculated efficiency of 10%. The design and response of a three-section, fast-neutron counter for application to low neutron flux dosimetry are given. A U^{235} thermopile was constructed which is capable of measuring

thermal-neutron fluxes from 5×10^7 to 5×10^{11} nv. Testing data for a Magnaflow continuous or pulsating liquid flowmeter are given. (D.L.C.)

21680 ORO-299
Arkansas. Univ., Little Rock. Graduate Inst. of Tech.
MASS SPECTROMETRY INSTRUMENTATION. Final Report and Research Proposal (Renewal). M. K. Testerman. Aug. 1, 1959. 76p. Contract AT(40-1)-2123. OTS.

A study of the properties associated with various metallic surfaces, relative to their application in ion source generation, was performed. Proved by this study is the feasibility of a system utilizing a combination of photoelectric emission and secondary electron multiplication as a cold electron source. The detailed study of the various phases of investigation (1-Photoelectric emission; 2-Secondary electron multiplication; 3-Application in a mass spectrometer) is described in this report. As a result of this investigation, a design was evolved in which ultra-violet radiation from a hydrogen arc lamp is transmitted through a sapphire window to impinge upon a tantalum photocathode. The photoelectric electrons then are multiplied by a 10- or 16-stage secondary multiplier. The electron output of the multiplier then is used for ionization. This cold electron source was used in an extremely dirty mass spectrometer tube, one which would be expected to abbreviate sharply the life of the source; yet, good spectra were obtained despite these conditions. Therefore, it is surmised that long, reliable operation might well be anticipated if this source were applied to a clean mass spectrometer tube, pumped with a Varian Vacion pump. Unlike that associated with thermionic emitters, electron emission utilizing this cold source does not undergo wild excursions; thus, emission regulations should be easily facilitated. It is believed that this type of cold electron source might be used to an advantage in other instruments involving ion generation, since it possesses several unique properties, one of which is rapid or high-frequency modulation of electron generation. Further studies will investigate the above-mentioned potentialities and anticipated performance characteristics. (auth)

21681 PPL-TR-60-2
Republic Aviation Corp. Plasma Propulsion Lab., Farmingdale, N. Y.
OPTIMUM CAPACITOR CHARGING EFFICIENCY FOR SPACE SYSTEMS. Philip M. Mostov, Joseph L. Neuringer, and Donald S. Rigney. Jan. 12, 1960. 33p. Contract Nonr-2851(00). OTS.

The optimum capacitor charging efficiency for space systems, e.g., a plasma engine, is discussed. The efficiency of energy transfer (η) to an initially uncharged condenser (C) when a d-c source voltage is applied through a resistance (R), with inductance (L) assumed zero, is shown limited to 50% even if R varies arbitrarily during the charging process. It is shown that if $L > 0$, η can be made to approach 100% by charging in a periodic mode and terminating at the end of the first $\frac{1}{2}$-cycle. To provide guide lines in the selection of practical voltage shapes, the Calculus of Variations is used to derive theorems for the "perfect" time-shaped source voltages that optimize η when the delivered energy, L, C, and T are fixed. Four modes of prescribing R, as a function of time (t) and/or current (i), are treated. The first is with a constant R where the key condition is constant i for the full charging time allowed; the voltage is a modified "elevated ramp"; $\eta_{opt} = 1/(1 + 2RC/T)$, can approach 100% and is independent of L. The other three modes are R(t), R(i), and R(t,i). Initial condenser voltages are shown to lead to improved η's, and are compatible for use with a plasma accelerator stage where they tend to imply large accelerator energy utilization factors. Promising voltage shapes, approximating the ideal, are derived. (auth)

21682 SCR-219
Sandia Corp., Albuquerque, N. Mex.
INERTIAL POWER SUPPLIES FOR BALLISTIC MISSILE RE-ENTRY VEHICLES. R. J. Martin. July 1960. 15p. OTS.

Reprinted with revisions from the Transactions of the Fourth Symposium on Ballistic Missile and Space Technology, Hdq, Air Force Ballistic Missile Division and Space Technology Labs., Los Angeles, California, August 24-27, 1959.

An inertial power supply, utilizing the kinetic energy of a movable mass to generate electrical energy, is described. Operational and design characteristics, together with some performance data on feasibility models, are presented. (auth)

21683 SCTM-208-54(54)
Sandia Corp., Albuquerque, N. Mex.
PULSE RESPONSE OF TERRAIN RETURN PROGRAM RECEIVERS. F. J. Janza, R. A. Hessemer, Jr., and C. S. Williams, Jr. Sept. 15, 1954. Reprinted July 13, 1960. 14p. OTS.

As an aid to analysis of pulse returns from the ground, the effects due to the ground and the receiver are interchanged. This makes it necessary to know how the receiver modifies the transmitter pulse. Two methods, one purely experimental and the other a combination of experimental measurements and analysis, are presented for finding this modified pulse. (auth)

21684 SCTM-215-53(51)
Sandia Corp., Albuquerque, N. Mex.
PRELIMINARY INVESTIGATION OF THE RESPONSE OF PRESSURE GAUGES TO DUST-LADEN AIR. J. R. Banister and Carter D. Broyles. Feb. 5, 1954. 22p. OTS.

An expression is derived for the dynamic pressure of pressure gages which includes the response to dust suspended in the shock wave. (C.J.G.)

21685 TID-6173
Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.
IN-LINE RADIOACTIVITY MONITORS. G. Jansen, Jr., J. C. Bolger, and B. E. Prince. Jan. 18, 1957. 15p. (KT-257). OTS.

A program for developing in-line instrumentation used in process lines for continuous measurement and control of process variables such as acidity, U concentration, and radioactivity is being carried out. (W.L.H.)

21686 WADC-TR-59-670
Dayton, Ohio. Univ.
TAPE RECORDING METHODS FOR DATA COLLECTION IN THE NEAR VICINITY OF A NUCLEAR DETONATION. Gordon W. Mills, Earl L. Lucius, and William J. Hovey. Sept. 1959. 72p. Project 1350. Contract AF33(616)-5008. (AD-231736).

Data collection within the fireball of a nuclear detonation by magnetic tape recording methods was proven feasible; however, the extreme environment has placed many restrictions and limitations upon the recording system used. Tape recording methods which lend themselves to such data collection are investigated, and the information necessary for the intelligent selection of any one of these methods for a particular set of given test conditions is provided. (W.D.M.)

21687 WT-329(Extract)
National Bureau of Standards. Radiation Physics Lab., Washington, D. C.
GAMMA RADIATION AS A FUNCTION OF TIME AND DISTANCE. L. Costrell. Apr. 1, 1952. Decl. Feb. 25, 1960. 47p. Project 2.1a [of] OPERATION JANGLE. OTS.

The preparation of gamma intensity measuring devices for the Jangle Operation is described up to installation in the pits. The detector used is a 4 π scintillating stilbene crystal with a light pipe for conducting the light from the crystal to a photoelectric device located in a pit. The topics discussed include field calibration of the detector, recording of the data, circuitry, and battery requirements. (D.L.C.)

21688 WT-374
Wright Air Development Center, Wright-Patterson AFB, Ohio.
OPERATION JANGLE. Project 4.1: AERIAL TECHNICAL PHOTOGRAPHY. Fred M. Crawford. Mar. 1952. Decl. Feb. 25, 1960. 70p. OTS.

With this are bound: Sandia Corp. Project 4.1a-1. GROUND TECHNICAL PHOTOGRAPHY MATERIAL OPERATIONS. Harold C. Barr. Project 4.1a-2. PHOTOGRAPHIC ANALYSIS. J. J. Miller. Mar. 26, 1952. OTS.

The methods and apparatus used in the sequence aerial photography of the physical phenomena of Operation Jangle are given in detail. Three C-47 type planes with multiple camera installations orbited over the target; each plane had 5 aerial still cameras, 3 35mm cameras, 1 16mm motion picture camera, and 1 35mm high-speed camera. Only 2 cameras failed completely during operation. The phenomena recorded included shock waves, base surge, cloud formation, and initial fireball. The operational aspects of photography are given for both surface and underground explosions. Analysis of the photographic results is given for the dimensions of the cloud and column from zero time to +3 min. (D.L.C.)

21689 WT-392
Naval Air Development Center, Johnsville, Penna.
GAMMA RADIATION AS A FUNCTION OF TIME WITH DROPPABLE TELEMETERS. Edward James Caris, Jr. and John H. Terry. Apr. 30, 1952. Decl. Feb. 25, 1960. 49p. Project 2.1b of OPERATION JANGLE.

Five droppable telemetering units were placed at varying distances from the detonation points of each of the two shots of Operation Jangle, the closest at 1000 ft and the farthest at 3000 ft. They were monitored from 0 to +15 min by ground- and air-based receivers. The data obtained are exhibited as continuous curves of roentgens per hour versus time. Subsequent air drops of units into the crater areas were unsuccessful. Recommendations are made for further development of the telemetering system. (auth)

21690 WT-398
Sandia Corp., Albuquerque, N. Mex.
GROUND TECHNICAL PHOTOGRAPHY MATERIAL OPERATIONS. Harold G. Barr. [195?]. Decl. Feb. 25, 1960. 21p. Project 4.1a-1 [of] OPERATION JANGLE. OTS.

The operational aspects of ground technical photography accomplished on Operation Jangle are reported. (auth)

21691 AEC-tr-4174
A SIMPLE PHOTOELECTRIC INSTRUMENT FOR MEASUREMENTS OF LIGHT SCATTERING. (Jednoduchý Fotoelektrický Přístroj Na Měření Rozptylu Světla). Ladislav Rosík and Otakar Vilím. Translated for Oak Ridge National Lab. from Chem. listy 53, 757-61(1959). 16p. (includes original, 5p.). JCL.

A photoelectric instrument is described for the measurement of light scattering, complete with an effective compensation of the intensity variations in a mercury arc lamp. The operation of the instrument and the reproducibility of its measurements were verified by a determination of particle sizes in a series of monodispersion latexes by the dissymmetry method. (W.L.H.)

21692 JPRS-5030(p.141-5)
THE MEASUREMENT OF SOFT β-RADIATION IN A THICK LAYER OF SUBSTANCE. N. A. Fedorov. Translated from Med. Radiol. 5, No. 1, 58-60(1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8562.

21693 JPRS-5030(p.178-80)
A DIRECT CURRENT VOLTAGE TRANSISTOR CONVERTER FOR THE POWER SUPPLY OF A DKZ DOSE METER. B. M. Abakumov. Translated from Med. Radiol. 5, No. 1, 73-4(1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8563.

21694 SCL-T-329
ON THE ASTIGMATISM IN MIRROR SPECTROMETERS. (Über den Astigmatismus bei Spiegelspektrometern). M. Czerny and A. F. Turner. Translated by Marcel I. Weinreich (Sandia Corp.) from Z. Physik 61, 792-7(1930). 7p. JCL.

In the case of mirror spectrometers, and depending upon the arrangement of the radiation course, it is possible for the errors to be either increased or partially annulled by the second concave mirror, whereby the initial error was introduced into the radiation course by the first concave mirror. The difference in the fusion of rays, as contrasted in these cases, is illustrated by means of photographic pictures. Many setups used in practical work correspond to the unfavorable case. (auth)

21695
CRYSTAL NEUTRON SPECTROMETER OF THE INSTITUTE OF ATOMIC PHYSICS OF THE ACADEMIA OF THE PEOPLES REPUBLIC OF RUMANIA. D. Bally, E. Tarină, Ş. Todireanu, and I. Olteanu. Acad. rep. populare Romîne, Inst. fiz. atomica şi Inst. fiz. Studii cercetări fiz. 11, 69-76 (1960). (In Rumanian)

A neutron spectrometer is described which can be operated as well with a plane crystal as with a curved crystal. The power of resolution of the apparatus is, for a calcite crystal, 0.53 μsec/m and, for the $(10\bar{1}0)$ plane of quartz, 1.23 μsec/m. (tr-auth)

21696
CONTRIBUTION TO THE METHOD OF ENERGY AND INTENSITY CALIBRATION OF SCINTILLATION γ SPECTROMETER. M. I. Cristu, V. P. Cojocaru, and D. I. Dorcioman. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 161-74(1960). (In Rumanian)

A new method for the energy measurement by means of a scintillation γ spectrometer is presented. The energy calibration of the spectrometer is done by means of pE = constant if the γ energy source is known. It is shown that the method of intensity calibration is based on the determination of the variation as a function of the energy of the ratio photo peak/total area. The results are compared with the theoretical results obtained by the Monte Carlo method

by other workers, and the reasons for the differences observed are given. The method was applied to the study of the level scheme of Fe^{59}. (tr-auth)

21697

PHOTOMULTIPLIER SUPPLYING INFLUENCE ON THE PERFORMANCE OF THE SYSTEM MEASURING THE MILLIMICROSECOND TIME INTERVALS. Tomasz Goworek. Ann. Univ. Mariae Curie-Skłodowska, Lubin-Polonia, Sect. AA, 12, 25-39(1957). (In Polish)

Conditions of energizing multipliers were studied in circuits used for measuring millimicrosecond time intervals. The influence of the volume charge of the electrons, of their focussing and scattering of the time of flight were measured using a photomultiplier FEU-33 (Russian make). It was found that the best results are obtained with a uniform potential distribution on the electrodes, except for the last two interelectrode intervals, the voltage of which is higher. The most convenient potential difference between the photocathode and diaphragm depends on the particular coincidence circuit and must be determined experimentally. (auth)

21698

A NEW TYPE OF SLOW NEUTRON COLLIMATOR. Pierre Denis and Dominique Roux (Laboratorie de Recherches Nucléaires, Institut de Physique, Geneva). Arch. sci. (Geneva) 12, 676-9(1959) Oct.-Dec. (In French)

An apparatus is described which overcomes some of the disadvantages of other neutron collimators. The apparatus consists of a stack of right circular cylinders with contact along their generatrices. These elementary cylinders form a large cylinder which is mechanically stable. The use of this collimator is described. (T.R.H.)

21699

THE HIGH-FREQUENCY DEFLECTION METHOD FOR MEASURING SHORT HALF-LIVES. PART II. THE ELECTRON COINCIDENCE SPECTROMETER AND RELATED ARRANGEMENTS USED IN CONNECTION WITH THE HIGH FREQUENCY DEFLECTION, TIME MEASURING INSTRUMENT. Torsten Alväger (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 17, 495-515(1960). (In English)

The focusing arrangements used in the experimental setup for investigation of the high-frequency deflection method for measuring short half lives (of the order of 10^{-10} sec or less) of isomeric states in nuclei are discussed. This includes a description of an electron-electron coincidence spectrometer. Further, the time spread in the analyzing magnets of this is considered. At present this time spread is about 10^{-10} sec, but can be decreased considerably, probably by a factor of 10, by a special design of the high-frequency deflection system. Some other arrangements, such as a special electrostatic system, which will increase the coincidence counting rate by about an order of magnitude and decrease the time spread, are also discussed. (auth)

21700

A PORTABLE SCINTILLOMETER WITH DIFFERENTIAL DISCRIMINATOR. H. Schneider and E. Schwerdtel (Physikalisches Institut der Universität, Giessen, Ger.). Atomkernenergie 5, 278-81(1960) July-Aug. (In German)

Continuing former research a portable transistorized scintillometer was developed, which not only permits the detection of radioactivity, but also the measurement of γ-energies by a pulse height analyzer combined with a decade scaler. In prospecting uranium, thorium and potassium can be distinguished. Some results are given. (auth)

21701

EFFECT OF LIQUID VAPORS ON THE OPERATION OF A POINT-DISCHARGE GEIGER-MÜLLER COUNTER. Antonin Hrbek (State Research Inst. for Conservation of Materials, Prague). Československ. časopis pro fysiku 9, 114-15(1959). (Translated from Referat. Zhur. Fiz. No. 2, 1960, abstract No. 2790).

The effect of liquid vapors (water, methanol, benzene, and mercury) on the production of a discharge was investigated in a point-discharge Geiger-Mueller counter. It is shown that the vapors of water in methanol, at a high field gradient, cause a spontaneous discharge in the counter. The amplitude of the discharge pulses, due to the liquid vapors, is considerably greater than that of the pulses produced by the electrons. The number of pulses increases with increasing vapor pressure. At very high field gradients near the counter point, the polar molecules of the liquid are oriented, become deformed, and then dissociate into ions, causing the discharge. The non-polar molecules in the field do not split up and therefore vapors of benzene and mercury, as shown by experiment, do not influence the operation of the counter. A suggestion is advanced, that the observed phenomena can be used in order to investigate evaporation of liquids or for analysis of gases.

21702

ON THE TEMPERATURE EFFECT OF SELF-QUENCHING GEIGER-MÜLLER COUNTERS. A. Peeva and T. Karatoteva. Compt. rend. acad. bulgare sci. 11, 359-62(1958). (Translated from Referat. Zhur. Fiz. No. 2, 1960, abstract No. 2786).

The temperature effect in Geiger-Mueller counters is frequently related to the adsorption of discharge-quenching vapors by the material of the anode and cathode of the counter. A detailed investigation was made of the comparative role of the adsorptions of the cathode and the anode in the temperature effect. For this purpose a study was made of the temperature effect in counters of identical constructions, in which the ability of adsorption of the cathode and anode material was artificially increased. Results obtained indicate a strong influence on the anode adsorption. Local heating of the anode by passage of direct current through it led to a complete restoration of the initial working characteristics of the counters during cooling of the counter.

21703

DELAY IN DISCHARGE DEVELOPMENT IN LOW VOLTAGE HALOGEN COUNTERS AS A FUNCTION OF THE TEMPERATURE. Compt. rend. acad. bulgare sci. 12, 17-20(1959). (Translated from Referat. Zhur. Fiz. No. 2, 1960, abstract No. 2789).

An experimental investigation was made of the temperature dependence of the delay time of pulses in Geiger-Mueller counters, filled with a mixture of argon and one of the halogen elements. The counter was connected for coincidence with a standard Geiger-Mueller Counter, filled with a mixture of argon and vapors of ethyl alcohol. The dependence of the number of coincidences between counters, due to cosmic rays, was measured as a function of the resolving power of the coincidence circuit. The delay time of the pulses in the standard counter (~0.1μ sec) was neglected. A noticeable dependence of the delay time of pulses on the counter temperature was observed; for example, at 360 volts applied to the counter, the delay time changes over a temperature range from 10 to 55°C from 6 to 9 microseconds. As the voltage on the counter is increased, the delay time of pulses is decreased.

21704

THE APPLICATION OF TRANSISTOR TECHNIQUES TO REACTOR CONTROL INSTRUMENTS. G. G. Ballard (Elliott Nucleonics Ltd., London). Ind. Rev. Africa. Suppl. Atomics and Energy 11, No. 11, 89-93(1960) May. (In English)

The application of transistor techniques to reactor control instruments was studied. Complete channels formed by the use of transistors made possible an indefinitely long working life. In order to obtain maximum flexibility, the equipment was designed in the form of a series of plug-in sub-units which made up a large number of "building bricks." Each brick formed a small but complete section of the whole instrument. The building bricks, housed in standard rack mounting cases, were used for direct current measurements or for pulse counting purposes. When the basic amplifier was arranged to form a switched linear channel, the response time was quite small. This system then was suitable for a large number of applications, from switched linear channels of relatively high currents to thermocouple inputs. A general pulse-counting channel employing brick units of both d-c and pulse form is shown schematically. By careful design, the noise charge sensitivity was made as low as 5×10^{-15} coulombs. Units monitoring d-c output voltage were provided with ratemeter amplifiers to provide trips and alarms for high flux. In order to provide necessary polarizing voltages for various detectors, it was necessary to generate E.H.T. supplies. Schematic diagrams for each of the circuits mentioned are included. (M.C.G.)

21705

CORROSION-RESISTANT SOLENOID CONTROL VALVE. H. L. Foltz and M. E. Tester (Goodyear Atomic Corp., Portsmouth, Ohio). Instr. Control Systems 33, No. 6, 1p. (1960) June.

A valve was designed to control the flow of corrosive liquids and consists of a pyrex tube with a conical seat, stopcock, and a solenoid wrapped around it just above the seat. A glass envelope with an iron rod sealed in the middle and with one end ground to fit the seat is lifted above the seat when the solenoid is energized, thus permitting flow. When the solenoid is not energized, the flow is shut off. (D.L.C.)

21706

DO SHIELDS IMPROVE T/C RESPONSE? C. E. Moeller (Midwest Research Inst., Kansas City, Mo.). ISA Journal 7, 56-9(1960) Aug.

The dynamic response of shielded, fine-wire thermocouples in measuring high-temperature gases was investigated. The role of the gas mass-flow rate was evaluated. At a mass-flow rate of 0.22 lb/sec/ft^2, results indicate that the maximum temperatures of the gases measured were reduced, and the time constant was increased as the radiation-shield cooling effect increased. Maximum temperatures were reduced by 20% by the use of radiation shields. Additional tests are proposed to study the shield cooling effect on the gas stream. (B.O.G.)

21707

4π SCINTILLATION COUNTER RECORDINGS OF DECAY EVENTS IN ELEMENT ELECTRON CAPTURES. V. I. Baranovskiĭ and G. M. Gorodinskiĭ (Khlopin Radium Inst., Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 313-23(1960) Mar. (In Russian)

A 4π scintillation counter with a crystal 30 mm in diameter and 25 mm high was used for measuring the number of decay events from electron capture. The counter is capable of recording radiation over 30 kev, has high sensitivity, and reduces error in coincidence measurements to 2 to 3% for elements with Z > 55. (R.V.J.)

21708

APPLICATION OF COINCIDENCE METHODS IN NUCLEAR SPECTROSCOPY. E. E. Berlovich (Leningrad Inst., of Physics and Tech.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 336-49(1960) Mar. (In Russian)

Applications of coincidence methods in nuclear spectroscopy with special devices including double coincidence scintillation spectrometers, double coincidence magnetic spectrometers, and double coincidence β-γ spectrometers are described. The design, performance, and efficiency of each spectrometer are illustrated. (R.V.J.)

21709

IONIZATION CHAMBER IN MAGNETIC FIELD. G. E. Kocharov and M. A. Yamshchikov (Inst. of Physics and Tech., Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 350-6(1960) Mar. (In Russian)

The influence of magnetic fields on ionization chamber devices is analyzed. Experimental data are presented for selecting correct geometry and operational conditions for ionization chambers in magnetic fields. It was found that a magnetic field does not affect resolving capacity with correct geometry and operating conditions and that magnetic fields can be used for reducing electron conversion effects. Ionization chambers are efficient for measuring accelerated particle beams and investigations of α spectra with strong β background. (R.V.J.)

21710

PULSES ON THE IONIZATION CHAMBER GRATING. G. A. Korolev and G. E. Kocharov. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 357-64(1960) Mar. (In Russian)

Applications of pulses from various chamber electrodes and various coincidence and anti-coincidence combinations are used for recording particle energies, angular distributions, points of emission (for nuclear reactions), and for reducing the background. By placing a second grid in the amplifier, it is possible to use the pulse of the first grid; the pulse amplitude depending on the particle emission angle. It is shown that in the case of grid pulses the optimum filtering band can be determined by the angular distribution function. Angular measurements with negative grid pulses exploit chambers filled with low-diffusion gases and permit the selection of undistorted amplifier filter band. With positive grid pulses, the chamber must be filled with gas in which the electron drift rate is high. Moreover, before passing the positive pulse through a differentiating chain it is necessary either to reduce or eliminate the negative part of the pulse grid. (R.V.J.)

21711

PHOTOELECTRON MULTIPLIER AMPLIFICATION DEPENDENCE ON THE PULSE AMPLITUDE AND TIME INTERVAL BETWEEN THEM. A. G. Berkovskiĭ and V. G. Pol'skiĭ. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 377-9(1960) Mar. (In Russian)

The "second" pulse amplitude as a function of time between pulses was investigated for a large number of photomultipliers using a specially designed installation. The photomultiplier supply voltage was 3 to 4 kv. Photomultiplier amplification coefficients were plotted as functions of time between pulse pair. The installation was also used for determining the relationship between the "second" and "first" pulse amplitudes at various time intervals between 0.1 and 2.5 μsec. The results show that with increased "first" pulse amplitude the amplitude of the "second" is reduced. (R.V.J.)

21712

COMPARISON OF IONIZATION AND COLORIMETRIC MEASUREMENTS OF γ RAY ENERGY FROM A SYNCHROTRON. S. P. Kruglov, Z. Kovarzh, and I. V. Lopatin (Leningrad Inst. of Physics and Tech.). Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz. No. 1, 3-11(1960). (In Russian)

Data on γ energies from an 85-Mev synchrotron were correlated in order to determine the causes of variations in the results (up to 25 to 30%) obtained by various methods. The γ energy necessary for producing a one coulomb charge in a special ionization chamber with copper walls was measured by calorimetric methods and by attenuation curves. The calorimetric method proved to be more direct and precise. The method requires no initial magnitudes and ratios, using only the assumption that all absorbed γ energy is spent on heating. The attenuation method produces reduced results for materials with large Z (lead) which is caused by erroneous linear extrapolation to ionization chamber zero thickness. The results of attenuation curves used with C, Al, and Cu (small Z materials) are in good agreement with the results of the calorimetric method, which indicates that with correct selection of all initial values the method is suitable for γ beam calibration. By eliminating the errors related to ρ and W, the order of precision is within 2 to 3%. (R.V.J.)

21713

ON MEASURING ATMOSPHERIC IONIZATION. V. A. Gubichev (Novosiberskiĭ Electro Technical Inst. of Communication, USSR). Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz. No. 1, 57-9(1960). (In Russian)

A formula is developed showing that the sensitivity of an ionometer does not depend on the effective volume of the condenser but on the ratio between electrometer volume and effective condenser volume. It is shown that at a certain point ionometer sensitivity only slightly depends on increased volume of the measuring condenser. Thus, a portable ionometer with a small condenser can be designed by selecting a small volume electrometer. (R.V.J.)

21714

INFLUENCE OF THE STRUCTURE OF IONIZATION ON THE VOLT-AMPERE CHARACTERISTICS OF FLUID IONIZATION CHAMBER. V. I. Ivanov (Moscow Inst. of Engineering Physics). Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz. No. 1, 119-23(1960). (In Russian)

The volt-ampere characteristics of fluid ionization chambers irradiated by x rays are described. An empirical formula is derived for the initial volt-ampere curve, and the variation in the spatial distribution of ions in a dielectric fluid with applied voltage is investigated. (tr-auth)

21715

INVESTIGATION OF SOME GLASSES FOR HIGH-LEVEL GAMMA-RADIATION DOSIMETERS. W. A. Hedden, J. F. Kircher, and B. W. King (Battelle Memorial Inst., Columbus, Ohio). J. Am. Ceram. Soc. 43, 413-15(1960) Aug.

Several glass systems were evaluated as dosimeters to measure integrated doses in the range from 10^6 to 10^9 rads by measuring optical density as a function of radiation dose. The two more promising glasses of those studied were Corning's Code 8392 and a special high-antimony glass. The maximum dosage that can be measured with these two glasses was not determined. In exposures up to 3×10^8 rads, there was continuous increase in optical density with dose, and no evidence of saturation at the highest doses used. Glasses also were prepared that darkened only slightly at dosages up to about 8.7×10^7 rads. Such glasses may have utility for measuring dosages above 10^9 rads. (auth)

21716

RADIATION DOSIMETER GLASSES. J. Paymal, M. Bonnaud, and P. Le Clerc (Compagnie de Saint-Gobain, Paris). J. Am. Ceram. Soc. 43, 430-6(1960) Aug.

Ionizing radiations produce visible colors in glasses containing certain multiple valence ions. The coloration, which is dependent on the radiation dose, is generally unstable. Combinations of certain ions can produce glasses with sufficient color stability to be used as dosimeters. Combinations of Mn-Fe, Mn-V, and Mn-V-Fe were studied. The response of glasses containing Mn-V-Fe was independent of the intensity of radiation and they may be used in the range between 10^5 to 2×10^7 roentgens. (auth)

21717

A FILM BADGE OF THE TNO. L. H. M. van Stekelenburg (KEMA, Arnhem, Netherlands). J. belge radiol. 43, 209-20(1960). (In Dutch)

A description is given of a film badge generally used in the Netherlands for roentgen and gamma radiations; the sensitivity of this badge does not depend on radiation energy. (auth)

21718

LOW ACTIVITY MEASUREMENTS IN WATERS. II. THE DESIGN OF CELL COUNTER. Jarmila Rálková and Jaroslav Slunečko (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Prague). Jaderná energie 6, 235-8 (1960). (In Czech.)

A counter was designed for direct measurements of low beta activity of liquids. The most important part of the counter is an exchangeable cell made from plastic scintillation material to which the measured liquid is pipetted. The background of the counter is 2 to 3 imp/min and geometric effectiveness is 80%. In drinking and surface waters it is possible to determine 10^{-8} μc/ml and 10^{-9} μc of an unknown mixture of isotopes in water with small salt content. Maximum error of measurement is ±30%. The preparation of a sample and the measurement takes 1 to 2 hours. (auth)

21719

THE CONSTRUCTION OF A GAMMA SPECTROMETER WITH DIFFRACTION CRYSTAL. Otto Schult (Technische Hochschule, Munich). Kerntechnik 2, 223-7(1960) July-Aug. (In German)

A spectrometer with diffraction crystal is described. It was constructed for the measurement of low-energy capture gamma radiation. The apparatus is in the irradiation chamber of the FRM Reactor. For the spectrometer the crystal plate was cut perpendicularly to the $10\bar{1}$ plane from a naturally grown crystal. The measurement range is between 20 and 330 kev for first-order diffractions. (tr-auth)

21720

HOLLOW NaI (Tl) CRYSTAL FOR DETERMINING WEAK GAMMA ACTIVITY. Janos Nagy and Rudolf Voszka. Magyar Fiz. Folyóirat 6, 483-6(1958). (Translated from Referat. Zhur. Fiz. No. 2, 1960, abstract No. 2770).

Description of the construction and the principal parameters of a scintillation counter with a NaI(Tl) crystal of barrel-shaped type are given. The counter is intended for measurement of weak gamma activities of solutions. A method of processing the crystal in order to obtain a barrel-like cavity is indicated.

21721

INVESTIGATION OF BF_3 PROPORTIONAL NEUTRON

COUNTERS. Margit Buczkó and Gyula Csikai. Magyar Tudományos Akad. Atommag Kutató Intézete (Debrecen), Közlemenyek 2, 29-35(1960). (In Hungarian)

The investigation of BF_3 proportional neutron counters revealed that by the effect of a strong gamma background the amplitude distribution of impulses produced by neutrons became distorted. The distortion of amplitude distribution in counters of various cathodes was examined as a function of electronic amplification. The results can be explained well by the screening effect of the positive space charge developed around the anode due to external radiation. (auth)

21722

INVESTIGATIONS WITH A SERVO APPARATUS. Lajos Csánky, István Papp, and Bálint Schlenk. Magyar Tudományos Akad. Atommag Kutató Intézete (Debrecen), Közlemenyek 2, 57-60(1960). (In Hungarian)

A servo apparatus sensitive to changes of neutron flux and experience gained in its use are reported. This device is a possible solution for the fine regulation of reactors and subcritical systems. In addition, it can be applied advantageously to stabilize thermal neutron flux produced. (auth)

21723

SCINTILLATION COUNTER AND SPECTROMETER. Gyorgy Mathe and Tibor Scharbert (MTA Atommag Kutato Intezet, Debrecen, Hungary). Meres es Automat. 7, No. 1, 1-6(1959). (Translated from Referat. Zhur. Fiz. No. 11, 1959, abstract No. 24275).

A description is given of an automatic scintillation gamma spectrometer. The scintillation counter is made in the form of a removable block and can be used separately to register radiation. A description and circuits are given for the electronic portions of the instrument.

21724

X-RAY SPECTROMETRY EXTENDS FILM-BADGE DOSIMETRY. W. V. Baumgartner (General Electric Co., Richland, Wash.). Nucleonics 18, No. 8, 76, 78-9(1960) Aug.

The range of film badges can be extended to 2000 r by measuring the silver content of developed films by x-ray spectrometry. The silver atoms are excited by x rays; the number of characteristic x rays emitted from the atoms as they return to the ground state is directly proportional to the silver content. The silver content is correlated to the amount of exposure, the larger the quantity of silver remaining in the film, the higher the radiation dose. During preliminary tests the x-ray spectrometry method overevaluated radiation doses absorbed by recently exposed standard films when compared with several-weeks-old standards. The average was 10% at 40 to 100 r and 60% at 1,000 to 2,000 r. The films showed significant fading between times of exposure and development at doses greater than 50 r. Film exposed to the x-ray beam in excess of 1 hr showed signs of hardening and emulsion flaking. The 1-min counts presently in use allow many re-evaluations before film damage is appreciable. (B.O.G.)

21725

AMBIENT RADIATION MONITOR. A. R. Jones (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nucleonics 18, No. 8, 80-2(1960) Aug.

The characteristics of a battery-operated radiation monitor are described. It has a G-M tube detector that covers a wide range and operates reliably for long periods. The output current is proportional to the logarithm of the radiation level from 10 μr/hr to 10 mr/hr and is sufficient to drive a 1-ma recorder. The monitor does not "block" even at excess intensities as high as 200 r/hr, four decades above normal full-scale. It contains a transistor circuit, the diagram of which is given. The average power consumption is about 1 w at 40 v, which can be provided for 1 week by batteries of 10-amp-hr capacity. (B.O.G.)

21726

A SIMPLE "TIME-TO-HEIGHT CONVERTER" FOR TRANSIT TIME EXPERIMENTS WITH SLOW NEUTRONS. K. H. Beckurts (Inst. für Neutronenphysik und Reaktortechnik, Karlsruhe, Ger.). Nukleonik 2, 129-31(1960) June. (In German)

The construction of a simple device is reported, which in combination with a commercial pulse-height analyzer can be used as a time analyzer for neutron experiments. (tr-auth)

21727

100-CHANNEL TIME-OF-FLIGHT ANALYZER FOR A SLOW-NEUTRON MECHANICAL CHOPPER. Aleksander Sawicki (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika 4, 567-71(1959). (In Polish)

Construction of the 100-channel analyzer is described. The analyzer yields a spectrum of neutron counts versus time-of-flight between a slow neutron chopper and neutron detectors. The detectors are placed some fixed distance (flight path) away from the mechanical chopper. The 100-channel analyzer must receive a "start" pulse from the neutron chopper and a "stop" pulse from the neutron detectors. The time duration between these two pulses furnishes an "on" gate to a 200 kc oscillator. The number of 200 kc pulses that pass through the "on" gate and through a preset frequency divider determines which of the 100 time-channels will receive the "stop" pulse. A decade scaler and a unit scaler polarize the proper column and row, respectively, of a 10×10 matrix of electromagnetic relays. Only the doubly polarized relay will store the "stop" pulse into its associated electro-mechanical register. Each of the electro-mechanical registers can receive up to 200 counts per second and can store up to 9999 counts. Channel widths of 5, 10, 20, 40, and 80 microseconds can be preselected by switching in 0, 1, 2, 3, or 4 binary frequency dividers in series with the 200 kc oscillator. The energy spectrum is obtained from the time-of-flight spectrum through the relationship: $t(\text{microseconds per meter}) = 72.3/E^{1/2}$ (electron volts). (TTT)

21728

THE THEORY OF NEUTRON CRYSTALLINE MONOCHROMATORS. Yu. G. Abov (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Pribory i Tekh. Eksp. No. 2, 3-14(1960) Mar.-Apr. (In Russian)

The theory of neutron diffraction is analyzed in order to systematize the data for practical applications in crystal spectrometers and diffractometers. The reflection properties of a perfect crystal, experimental determination of angular divergence of diffracted neutrons, and high-order reflection are analyzed mathematically. (R.V.J.)

21729

CHERENKOV TOTAL ABSORPTION γ SPECTROMETER. V. F. Grushin, V. A. Zapevalov, and E. M. Leikin (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Eksp. No. 2, 27-32(1960) Mar.-Apr. (In Russian)

Descriptions are presented of a Cherenkov total absorption γ spectrometer with a lead glass radiator for recording γ radiation at 250 Mev. Specifications and experimental characteristics of the spectrometer are compared with spectrometers of other types. (tr-auth)

21730

MULTISPECTROGRAPH-MAGNETIC ANALYZER OF CHARGED PRODUCTS PRODUCED BY NUCLEAR REACTIONS. Yu. A. Nemilov and V. F. Litvin (Radium Inst., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 32-4(1960) Mar.-Apr.

A magnetic analyzer with emulsion recording of charged products is described. The spectrometer is capable of producing simultaneously nine energy spectra of reaction products emitted from the target at 0 to 90°. The energies of particles simultaneously recorded in each spectrum, and the luminosity and resolving power (~1%) of the apparatus are calculated. (tr-auth)

21731

COUNTERS FOR MEASURING WEAK ACTIVITY. K. A. Petrzhak and R. V. Sedletskiĭ (Leningrad Inst. of Tech.). Pribory i Tekh. Ekspt. No. 2, 34-7(1960) Mar.-Apr. (In Russian)

Three spherical chambers made of stainless steel, teflon, and polyethylene, having rotating spherical counters of teflon with thin perchlorovinyl windows, are described. The counter background is 2 to 7 pulses/min. The counters can be utilized for absolute or relative measurements on radioactive materials with several decays per minute. (tr-auth)

21732

FRONT WINDOW COUNTERS FOR WEAK ACTIVITY BETA RADIATION. T. I. Dmetrievskaya, V. V. Kravtsev, and N. E. Tsvetaeva. Pribory i Tekh. Ekspt. No. 2, 38-40 (1960) Mar.-Apr. (In Russian)

The construction of counters made of glass with potassium content less than 0.1% and a screening quartz membrane for reducing background is described. The counters in an anticoincidence scheme are capable of measuring weak preparations of β active isotopes, including water with a maximum permissible content of $Sr^{90}-Y^{90}$. (tr-auth)

21733

PERFORMANCE OF PULSE OPERATED GAS DISCHARGE COUNTERS. Yu. N. Vavilov and I. A. Prager (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 41-4(1960) Mar.-Apr. (In Russian)

The performance of gas-discharge counters in a pulse-operated hodoscope is investigated. (tr-auth)

21734

DIFFUSION CHAMBER WITH CONSTANT VOLUME AND TIME SATURATION. V. B. Deryagin, P. S. Prokhorov, M. V. Velichko, and L. F. Leonov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 45-7(1960) Mar.-Apr. (In Russian)

Vapor condensation on the walls and heat exchange interfere with vapor saturation in Wilson and diffusion chambers. A new method is suggested for obtaining saturation by creating periodic temperature variations at the chamber wall. (R.V.J.)

21735

HODOSCOPE SYSTEM OF PULSE OPERATED COUNTERS. I. M. Vasilevskiĭ and V. V. Vishnyakov (Joint Inst. for Nuclear Research, Dubna, USSR). Pribory i Tekh. Ekspt. No. 2, 58-63(1960) Mar.-Apr. (In Russian)

A hodoscope system of gas discharge counters with controlled pulse supply was used with a synchrocyclotron in order to study π^- meson scattering by protons. The system consisted of 426 counters. The effective recording of particles before the appearance of a high-intensity pulse with several μsec resolving time is stressed. Vertical cross section of the hodoscope and a block scheme of the electronic system are included. The performance of the system is discussed. (R.V.J.)

21736

HODOSCOPE WITH SEMICONDUCTORS. I. D. Rapoport and N. N. Goryunov (Moscow State Univ.). Pribory i Tekh. Ekspt. No. 2, 72-4(1960) Mar.-Apr. (In Russian)

A description is presented of an economical hodoscope system equipped with semiconductor triodes. (tr-auth)

21737

GENERATOR FOR STUDYING ELECTRON PARAMAGNETIC RESONANCE. A. V. Kubarev and Yu. A. Mezenev (Sverdlovsk Div. of All-Union Scientific-Research Inst. of Metrology, USSR). Pribory i Tekh. Ekspt. No. 2, 86-9 (1960) Mar.-Apr. (In Russian)

A modified scheme is given for a regenerative detector with capacitance coupling for observing electron paramagnetic resonance in weak magnetic fields. The regenerative generator possesses high sensitivity to electron paramagnetic resonance in free radicals, which can be utilized in electron magnetometers for measuring weak magnetic fields. (tr-auth)

21738

SPECTROMETER FOR NUCLEAR MAGNETIC RESONANCE IN CRYSTALS. A. G. Ludin and G. M. Mikhailov (Inst. of Physics, Siberian Div., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 90-2(1960) Mar.-Apr. (In Russian)

A rotating-magnet spectrometer was used in nuclear resonance investigation of crystals exhibiting anisotropic phenomena at various crystal orientations. The principle scheme of the spectrometer consists of a π-shaped magnet with a heterogeneous field of 0.03 gauss per cm^3, an autodyne generator with a high transconductance tube, a narrow band amplifier, and a phase detector. The spectra are recorded by an automatic potentiometer. (tr-auth)

21739

RESONANCE MEASURING OF MAGNETIC FIELD INTENSITY. N. I. Leont'ev. Pribory i Tekh. Ekspt. No. 2, 93-8(1960) Mar.-Apr. (In Russian)

A device for measuring magnetic field intensity based on cyclotron resonance of hydrogen ions is described. The intensity is measured by the cyclotron frequency differences of H^+ and H_2^+ or H_2^+ and H_3^+ ions. The device is capable of measuring intensities up to 31,500 gauss and can be used for measuring, within the transducer capacity, the mean intensities of fields with large heterogeneities. The device supplies absolute intensity values with an order of accuracy of ±0.5%. (tr-auth)

21740

AUTOMATIC DEVICE FOR MEASURING SPECTRA IN MAGNETIC SPECTROMETERS. I. Ya. Korol'kov and N. A. Burgov. Pribory i Tekh. Ekspt. No. 2, 99-103(1960) Mar.-Apr. (In Russian)

The scheme and design of a device for automatically measuring spectra in a magnetic spectrometer are described. The stability of the magnetic field is 5×10^{-4}. The order of error is ±0.08 gauss. (tr-auth)

21741

MASS SPECTROMETER WITH HIGH VACUUM MASS ANALYZER. G. Ya. Pikus (Kiev State Univ., USSR). Pribory i Tekh. Ekspt. No. 2, 104-6(1960) Mar.-Apr. (In Russian)

A short description is given of a laboratory-type mass

spectrometer with a glass analyzer used in investigations of cathode electronics and physics of ultrahigh vacuum. Strong outgassing creates a vacuum ~10^{-8} mm Hg and eliminates the interference of chemically active gases. The low background of residual gases and utilization of an electron multiplier at the outlet improves the sensitivity. (tr-auth)

21742

SELECTOR FOR STUDYING MOLECULAR VELOCITIES. V. B. Leonas and V. K. Rubtsov (Moscow State Univ.). Pribory i Tekh Ekspt. No. 2, 115-18(1960) Mar.-Apr. (In Russian)

A design of a high-speed selector capable of producing intermittent molecular beams and measuring molecular velocities is described. Specifications, measuring capacity, and operation of the device are analyzed, and principles of molecule selection by velocities are discussed. (tr-auth)

21743

ION FLUX MEASUREMENTS BY ION ACCELERATING SYSTEM. V. A. Egorov, D. V. Karetnekov, and S. N. Popov (Inst. of Chemical Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 146-8(1960) Mar.-Apr. (In Russian)

The disadvantages of measuring large currents (>10 ma) in ion acceleration tubes are described. The results of electric measurements are compared with measurements carried out by thermal methods. (tr-auth)

21744

CYCLOTRON TYPE HIGH-FREQUENCY ION SOURCE. N. N. Krasnov. Pribory i Tekh. Ekspt. No. 2, 148-50 (1960) Mar.-Apr. (In Russian)

An attempt was made to develop a cyclotron ion source based on high-frequency discharge in which dispersion of electrode material is considerably reduced. The design of the source and the results of the tests are described. (R.V.J.)

21745

ION TUBE PERFORMING AT 50 kw. I. V. Orfanov and V. A. Teplyakov (Inst. of Chemical Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 150-2 (1960) Mar.-Apr. (In Russian)

Descriptions are given of an ion source with a low-voltage arc and dual plasma density at 50 kw and an ion flux up to 20 ma. (R.V.J.)

21746

CALCULATION OF CORRECTING COILS FOR A β-SPECTROMETER OF THE SOLENOID TYPE AND MEASUREMENT OF MAGNETIC FIELDS PRODUCED BY SOLENOID AND CORRECTING COILS. Horacio E. Bosch. Publs. com. nacl. energía atómica (Buenos Aires) Misc. No. 2, 1-10(1956). (In Spanish)

Two types of correcting coils to make the magnetic field homogeneous along its central axis over 40 cm were calculated. The intensity of the total magnetic field produced by the solenoid and the correcting coils in both cases was given. The relative errors of the value of the field at a point distant 20 cm when checked against the value of the field in the center, are of the same order for the two types. Relative measurements of the intensity of the total magnetic field along the central axis and along four parallels were made. The results show that a homogeneity of 1% can be obtained over 40 cm along the above mentioned axis. (auth)

21747

ONE CHANNEL SCINTILLATION SPECTROMETER. Kurt Franz and Santiago F. Pinasco. Publs. com. nacl. energía atómica (Buenos Aires) Ser. fis. 1, No. 13, 225-42(1957). (In Spanish)

A fast, compact, one-channel scintillation spectrometer was developed for the study of isotopes with short or medium half lives. Performance data, circuits, and methods for checking are presented in detail. (auth)

21748

ABSORPTION ANALYSIS OF X-RAY SPECTRA PRODUCED BY BERYLLIUM WINDOW TUBES OPERATED AT 20 TO 50 Kvp. Edward A. Burke and Ralph M. Pettit (Air Force Cambridge Research Center, Bedford, Mass.). Radiation Research 13, 271-85(1960) Aug.

It has been shown that absorption analysis can be employed to determine the spectrum of an x-ray beam containing characteristic x-ray lines superimposed on the continuous spectrum. In order to analyze such beams it is necessary to collect absorption data on a second tube, identical to the first except for target material, and operated at the same voltage and current. The method was used to determine the spectra of four different x-ray tubes operated at three different voltages. It was found that the continuous spectrum could be represented by a simple function containing only two constants. One of the constants proved to be independent of tube target material and applied voltage; the other, a function of voltage only. The integrated intensity of the continuous radiation was found to vary directly as the atomic number of the tube target and the square of the voltage applied. (auth)

21749

USE OF SPARK COUNTERS FOR THE DETECTION OF FAST NEUTRONS. Rev. phys., Acad. rép. populaire Roumaine 3, 203-10(1958). (Translated from Referat. Zhur. Fiz. No. 2, 1960, abstract No. 2794).

An investigation was made of the possibility of detecting fast neutrons with the aid of spark counters. Two types of counters were used: with filament-like anode and plane (or half-cylindrical) cathode and with plane cathodes and an anode made of parallel wires. The cathode was made of polished brass, the anodes of tungsten wire 0.1 mm in diameter. The counters were filled with air, nitrogen, and hydrogen. When the counters were filled with air, because of production of ozone, oxidation of the electrodes was noticed and a change was seen in the operating characteristics of the counters with time. All the counters had a voltage plateau approximately 400 volts long. The efficiency to fast neutrons for a counter with three filaments, filled with nitrogen, hydrogen, and air, is 10^{-3}, 6×10^{-4}, and 10^{-4}%, respectively. The counter is practically insensitive to gamma rays.

21750

LUMINESCENCE SPECTROMETER FOR THE INVESTIGATIONS OF γ SPECTRA OF RADIOACTIVE NUCLEI. G. S. Dombrovskaya, D. K. Kaipov, and Yu. K. Shubnyi. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 115-23(1960). (In Russian)

The design, specifications, and performance are given of a scintillation spectrometer for measuring the distribution of pulses according to their magnitudes (1, 2, 3, 7). The spectrometer is divided into two compartments: the first contains the crystal (NaI(Tl) and CsI(Tl), 29 mm in diameter and 12 mm in thickness), photomultiplier, and cathode repeater; the second contains the amplifier and a single-channel differential amplitude analyzer. The linear amplifier is designed on a two-cascade scheme with negative feedback, 1 Mc penetration band, and an amplification

factor of 100. The output of the linear amplifier is 120 v. A high resolving power multiplier was selected by comparing photo-peaks of Hg^{203}, Zn^{65}, and Co^{60}. It is shown that NaI(Tl) and CsI(Tl) crystals offer a more efficient count of γ quanta. (R.V.J.)

21751

IONIZATION CHAMBER WITH ELECTRONIC DEVICE FOR THE MEASUREMENT OF VERY LOW CONCENTRATIONS OF Ra IN ROOMS. Vlastimir M. Vucic and Gojko Dimic. Univ. Belgradu. Publ. Elektrotehn. Fak. Ser. Mat. i Fiz. No. 22, (1958). (Translated from Referat. Zhur. Fiz. No. 11, 1959, abstract No. 24363)

A description is given of an ionization chamber with a d-c amplifier, intended for the measurement of very low concentrations of radium in rooms. The volume of the chamber is considerably increased in order to maintain the ionization current sufficient for stable and reliable operation of the d-c amplifier. The chamber is installed stationary in the room in which the concentration of radium is to be measured.

21752

A NEW RADIOLOGICAL VACUUM GAUGE. G. Frederick Vanderschmidt and John C. Simons, Jr. (National Research Corp., Cambridge, Mass.). p.305-7 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In English)

Tritium, the radioactive isotope of hydrogen, is advantageously employed as the ionizing source in a radiological vacuum gage. The source consists of a thin layer of zirconium or titanium by which the tritium is occluded. Because of the complete absence of penetrating radiation, high intensity sources may be used, permitting the convenient measurement of pressures down to 10^{-5} mmHg. Investigation of the stability in vacuum of the currently available sources indicates an upper limit of about 100°C for operation of the sources. A gage covering the range of pressure measurement from atmospheric to a lowest full-scale reading of 1 μ Hg is constructed using two ion chambers; a balanced electrometer amplifier is used to measure the ion current. (auth)

21753

Argentina. Comision Nacional de Energia Atomica, Buenos Aires.

AMPLIFICADOR LINEAL. Informe No. 1. (Linear Pulse Amplifier. Report No. 1). Ricardo A. P. Gayoso and Santiago F. Pinasco. 1958. 14p.

A linear amplifier with the following characteristics is described: gain, 1000; output pulse amplitude, 100 volts (positive); rise time, 0.15 μsec; decay time, 0.44 μsec. (W.L.H.)

21754

Argentina. Comisión Nacional de Energía Atómica, Buenos Aires.

MICRO-MICROAMPERIMETRO. Informe No. 3. (Micro-Microammeter. Report No. 3). Manfredo C. Kopp and Santiago F. Pinasco. 1958. 9p.

A micro-microammeter with excellent accuracy, zero stability, and speed of response was developed for the measurement of small ion currents. Performance data, circuits, and theory are presented in detail. (auth)

21755

IMPROVEMENTS IN OR RELATING TO INDICATING ARRANGEMENTS FOR RING SCALING CIRCUITS. John Bernard James and Ernest Franklin (to United Kingdom Atomic Energy Authority). British Patent 841,614. July 20, 1960.

An arrangement is described for ring scaling circuits. The magnetic memory ring scaling circuit consists of a ring of bistable stages each having a high-remanence magnetic core and connected in a continuous shift circuit so that the pattern of stable states moves one stage around the ring with each input pulse. (W.L.H.)

21756

IMPROVEMENTS IN OR RELATING TO SCALING CIRCUITS. Ernest Franklin. (to United Kingdom Atomic Energy Authority). British Patent 841,615. July 20, 1960.

A magnetic memory shift or scaling circuit of the type consisting of a number of magnetic elements is described. Each element has an associated capacitor and a unidirectional conducting device. (W.L.H.)

21757

IMPROVEMENTS IN RADIATION GAUGES. Gordon Francis Wellington Powell (to Molins Machine Co., Ltd.). British Patent 842,122. July 20, 1960.

The design of radiation gages for use on continuous rod cigarette-making machines to determine the mass of the moving rod is reported. (W.L.H.)

21758

IMPROVEMENTS IN OR RELATING TO APPARATUS EMPLOYING A D. C. ENERGISED ELECTRIC ARC. Wilfred Jaques (to United Kingdom Atomic Energy Authority). British Patent 842,584. July 27, 1960.

An apparatus employing a d-c energized electric arc is described. The apparatus is used for the measurement and recording of arc currents and voltages by a self-balancing d-c potentiometer. (W.L.H.)

21759

THERMOCOUPLE VACUUM GAUGE. G. W. Price (to U. S. Atomic Energy Commission). U. S. Patent 2,685,665. Aug. 3, 1954.

A protector device is described for use in controlling the pressure within a cyclotron. In particular, an electrical circuit functions to actuate a vacuum pump when a predetermined low pressure is reached and disconnect the pump when the pressure increases above a certain value. The principal feature of the control circuit lies in the use of a voltage divider network at the input to a relay control tube comprising two parallel, adjustable resistances wherein one resistor is switched into the circuit when the relay connects the pump to a power source. With this arrangement the relay is energized at one input level received from a sensing element within the cyclotron chamber and is de-energized when a second input level, representing the higher pressure limit, is reached.

21760

N^2 SCALER. C. W. Johnstone (to U. S. Atomic Energy Commission). U. S. Patent 2,931,570. Apr. 5, 1960.

Apparatus are described for indicating the numerical square of a plurality of random occurring input pulses occurring within a number of selected intervals and comprise an input storage scaler having a selected number of cascaded scaler stages, a follow-up scaler having a number of stages equal to the input storage scaler, a comparison circuit coupled between like output circuit points of each input scaler stage and its corresponding follow-up scaler stage, a local pulse source, a squaring scaler comprising a number of cascaded stages equal to twice the number of input storage scaler stages, half of said squaring scaler stages corresponding in order to the order of

the input storage scaler stages and having a gated input, means for opening the gated inputs of those squaring scaler stages which correspond to triggered input storage scaler stages, and means for coupling the local source of pulses to all of the gates.

21761

ELECTRON GUN. N. C. Christofilos and K. W. Ehlers (to U. S. Atomic Energy Commission). U. S. Patent 2,931,939. Apr. 5, 1960.

A pulsed electron gun capable of delivering pulses at voltages of the order of 1 mv and currents of the order of 100 amperes is described. The principal novelty resides in a transformer construction which is disposed in the same vacuum housing as the electron source and accelerating electrode structure of the gun to supply the accelerating potential thereto. The transformer is provided by a plurality of magnetic cores disposed in circumferentially spaced relation and having a plurality of primary windings each inductively coupled to a different one of the cores, and a helical secondary winding which is disposed coaxially of the cores and passes therethrough in circumferential succession. Additional novelty resides in the disposition of the electron source cathode filament input leads interiorly of the transformer secondary winding which is hollow, as well as in the employment of a half-wave filament supply which is synchronously operated with the transformer supply such that the transformer is pulsed during the zero current portions of the half-wave cycle.

21762

HIGH VOLTAGE ION SOURCE. J. S. Luce (to U. S. Atomic Energy Commission). U. S. Patent 2,933,630. Apr. 19, 1960.

A device is described for providing a source of molecular ions having a large output current and with an accelerated energy of the order of 600 kv. Ions are produced in an ion source which is provided with a water-cooled source grid of metal to effect maximum recombination of atomic ions to molecular ions. A very high accelerating voltage is applied to withdraw and accelerate the molecular ions from the source, and means are provided for dumping the excess electrons at the lowest possible potentials. An accelerating grid is placed adjacent to the source grid and a slotted, grounded accelerating electrode is placed adjacent to the accelerating grid. A potential of about 35 kv is maintained between the source grid and accelerating grid, and a potential of about 600 kv is maintained between the accelerating grid and accelerating electrode. In order to keep at a minimum the large number of oscillating electrons which are created when such high voltages are employed in the vicinity of a strong magnetic field, a plurality of high voltage cascaded shields are employed with a conventional electron dumping system being employed between each shield so as to dump the electrons at the lowest possible potential rather than at 600 kv.

21763

FREQUENCY STABILIZING SYSTEM. Q. A. Kerns and O. A. Anderson (to U. S. Atomic Energy Commission). U. S. Patent 2,935,686. May 3, 1960.

An electronic control circuit is described in which a first signal frequency is held in synchronization with a second varying reference signal. The circuit receives the first and second signals as inputs and produces an output signal having an amplitude dependent upon rate of phase change between the two signals and a polarity dependent on direction of the phase change. The output may thus serve as a correction signal for maintaining the desired synchronization. The response of the system is not dependent on relative phase angle between the two compared signals. By having practically no capacitance in the circuit, there is minimum delay between occurrence of a phase shift and a response in the output signal and therefore very fast synchronization is effected.

21764

RADIATION DOSIMETER. W. R. Balkwell, Jr. and G. D. Adams, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,936,372. May 10, 1960.

An improvement was made in the determination of amounts of ionizing radiation, particularly low-energy beta particles of less than 1000 rad total dose by means of fluid-phase dosimeter employing a stabilized–sensitized ferrous-ferric colorimetric system in a sulphuric acid medium. The improvement in the dosimeter consists of adding to the ferrous-ferric system in concentrations of 10^{-2} to 10^{-4}M an organic compound having one or more carboxylic or equivalent groups, such compounds being capable of chelating or complexing the iron ions in the solution. Suitable sensitizing and stabilizing agents are benzoic, phthalic, salicylic, malonic, lactic, maleic, oxalic, citric, succinic, phenolic tartaric, acetic, and adipic acid, as well as other compounds which are added to the solution alone or in certain combinations. As in conventional fluid-phase dosimeters, the absorbed dosage is correlated with a corresponding change in optical density at particular wavelengths of the solution.

21765

RADIATION DETECTOR. H. N. Wilson and F. M. Glass (to U. S. Atomic Energy Commission). U. S. Patent 2,936,401. May 10, 1960.

A radiation detector of the type is described wherein a condenser is directly connected to the electrodes for the purpose of performing the dual function of a guard ring and to provide capacitance coupling for resetting the detector system.

21766

PERSONNEL NEUTRON DOSIMETER. J. J. Fitzgerald and C. G. Detwiler, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,938,121. May 24, 1960.

A description is given of a personnel neutron dosimeter capable of indicating the complete spectrum of the neutron dose received as well as the dose for each neutron energy range therein. The device consists of three sets of indium foils supported in an aluminum case. The first set consists of three foils of indium, the second set consists of a similar set of indium foils sandwiched between layers of cadmium, whereas the third set is similar to the second set but is sandwiched between layers of polyethylene. By analysis of all the foils the neutron spectrum and the total dose from neutrons of all energy levels can be ascertained.

Materials Testing

21767 DP-164

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.

A NONBOND DETECTOR FOR HOLLOW SLUGS. John D. Ross and Richard W. Leep. Oct. 1956. Decl. Mar. 30, 1960. 14p. Contract AT(07-2)-1. OTS.

A tester was developed to detect nonbonded areas between the cladding and the core of hollow slugs. These slugs are one inch in diameter and eight inches long, and have a $\frac{3}{8}$ inch axial hole. The tester employs an ultrasonic detector previously developed at the Savannah River Laboratory. A transducer $\frac{5}{16}$ inch in diameter was developed to

pass down the inside of the slug and a mechanical feeder was constructed to provide an automatic inspection cycle. (auth)

21768 HW-48875

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

EVALUATION OF ULTRASONIC ATTENUATION TECHNIQUES FOR TESTING HOLLOW URANIUM CORES FOR TRANSFORMATION. C. L. Frederick. Mar. 5, 1957. Decl. Mar. 16, 1960. 9p. OTS.

Techniques for measuring ultrasonic attenuation such as straight through transmission, use of inner probes, and reflection techniques were tested. While several of these methods could be used, none of them would give any appreciable over-all improvement. Improvements in standards and crystal adjustment mechanisms should provide satisfactory operation of the test using the present method. Selection of new standards can be made more accurately by techniques learned during the evaluation. (auth)

21769 KAPL-M-AJV-1

Knolls Atomic Power Lab., Schenectady, N. Y.

NONDESTRUCTIVE TESTING OF B_{10} SS POISON WIRE. Andrew J. Valachovic and Robert C. Holt. Mar. 25, 1960. 23p. Contract W-31-109-eng-52. OTS.

An investigation was made to determine if an eddy current technique could replace the dye penetrant test required on B_{10} SS poison wire. Artificial and natural defects were evaluated on four types of eddy current equipment. The eddy current tests detected sub-surface voids and surface defects as small as 0.0030 in. deep and 0.0015 in. wide. The results showed that the eddy current test was not so sensitive to shallow surface defects as the dye test; however, the dye test could not detect sub-surface voids. (auth)

21770 KAPL-M-WHP-1

Knolls Atomic Power Lab., Schenectady, N. Y.

THE FEASIBILITY OF BUBBLE TESTING RHOMBUS AND CLUSTER ASSEMBLIES. Walter H. Pappin. July 11, 1960. 11p. Contract W-31-109-Eng-52. OTS.

There were strong doubts that a bubble test could validly display real leaks in a rhombus subassembly. It was postulated that outgassing could mask bubbles, produced by an assembly caused defect. The structural plate has small sealed-off holes containing a small amount of gas at approximately atmospheric pressure. It was shown that when a simulated 10^{-4} leak is placed in the channel, it is readily detected under vacuum. The feasibility study performed on a short section of rhombus proved that a full sized rhombus could be readily bubble tested. (auth)

21771 SCL-T-325

TESTING OF SOFT ELASTIC FOAM MATERIALS. PROLONGED ENDURANCE VIBRATION TEST (DETERMINATION OF COMPRESSION-AND SHEARING FATIGUE). GERMAN INDUSTRIAL STANDARDS: DIN 53 574. (Prüfung von Weichelastischen Schaumstoffen, Dauerschwingversuch, (Bestimmung der Stauch- und der Scherermüdung). (Deutsche Industrie Norm) DIN 53 574). Translated by Marcel I. Weinreich (Sandia Corp.). 4p. JCL.

A prolonged endurance vibration test to evaluate the behavior of soft-elastic foam materials in vibrating stressed during alternate compression and unburdening, and during alternate shearing in opposite directions is described. It is noted that the test specification is tentative. (J.R.D.)

21772 SCL-T-326

TESTING OF SOFT ELASTIC FOAM MATERIALS. DETERMINATION OF IMPACT ELASTICITY. GERMAN INDUSTRIAL STANDARDS: DIN 53 573. (Prüfung von Weichelastischen Schaumstoffen, Bestimmung der Stosselastizität. (Deutsche Industrie-Norm). DIN 53 573). Translated by Marcel I. Weinreich (Sandia Corp.). 5p. JCL.

A method for determination of impact elasticity which serves to evaluate the behavior of soft-elastic foam materials subjected to shock-like stresses is outlined. It is noted that the specification is a preliminary draft. (J.R.D.)

GEOLOGY, MINERALOGY, AND METEOROLOGY

21773 NYO-8919

Carnegie Inst. of Tech., Pittsburgh.

THORIUM ISOTOPES METHOD FOR DATING MARINE SEDIMENTS (thesis). Ismael Almodovar. May 31, 1960. 125p. Contract AT(30-1)-844. OTS.

A radiochemical modification of the ionium (Th^{230}) method of dating marine sediments, based on measurements of four isotopes of Th (Th^{230}, Th^{232}, Th^{234}, and Th^{228}), was developed. A sample of chemically and radiochemically pure Th is isolated from the sediment sample. The (Th^{230}/Th^{232}) activity ratio is determined from the time dependence of the total beta activity of the sample. The latter ratio is equal to the (U^{238}/Th^{232}) activity ratio. The difference $I = (Th^{230}/Th^{232}) - (Th^{234}/Th^{228})$ is the ionium excess on a Th-normalized basis. It is related to the age T of the sample by $I = I_0 e^{-\lambda T}$, where I_0 is the effective value of I at the time of deposition and λ is the disintegration constant of ionium. (auth)

21774 JPRS-5010

CERTAIN TYPES OF PNEUMATOLYTIC-HYDROTHERMAL BERYLLIUM DEPOSITS. A. I. Ginzberg, A. A. Beus, A. A. Sitkin, N. P. Zabolotnaya, and M. I. Novikova. Translated from Geol. Mestorozhdenii Redkikh Elementov, Vsesoyuz. Nauch. Issledovatel Inst. Mineral. Syr'ya, No. 4, 1-54(1959). 60p. OTS.

A general characterization of the following Be deposits was made: pneumatolytic-hydrothermal deposits and beryl-bearing zones in granodiorites. Methods of mining, occurrence, and typical mineralization of such deposits are discussed. The genesis of Be mineralization in granites is discussed. (C.J.G.)

21775

THE CONCENTRATION OF RADON IN THE SOIL SUBSTRATUM OF CERTAIN REGIONS IN THE LUBLIN DISTRICT. Emanuel Trembaczowski. Ann. Univ. Mariae Curie-Skłodowska, Lubin-Polonia, Sect. E, 13, 195-207 (1958). (In Polish)

Measurements taken of the radon content of soil substratum in the Lublin District show that the highest amount of that gas is contained in clay and loess formations. The radon concentrations of these formations vary from 7–19 emans (1 eman = 10^{-10} curie/liter). Turfy and sandy areas are more impoverished, containing considerably smaller amounts of this element (the activity of turf reaches 0.21 em., whereas that of sand reaches 2.20 em.). The large radon content of loess and clay is due to the considerable concentration of its parent element, radium, in these formations. The greater amount of radon found in clay as compared to that in the loess can be explained by the greater ability of gases to diffuse through loess, which, in contrast to clay, is characterized by high porosity. (auth)

21776

USE OF THE ISOTOPIC COMPOSITION OF LEAD IN SUR-

VEYS FOR URANIUM ORES. D. Ya. Surazhskiĭ and A. I. Tugarinov. Atomnaya Energ. 9, 21-6(1960) July. (In Russian)

Probable causes of anomalous lead developments and the feasibility of utilizing isotopic lead anomalies in prospecting for uranium deposits are analyzed. The appearance of lead with a high content of radiogenic isotopes (Pb^{207} and Pb^{206}) is assumed to be the result of the following geological processes: the rapid accumulation of young precipitants resulting from an intense erosion of ancient uranium deposits; magma assimilation and deep granitization of uranium-bearing rocks developed long before magmatization; hydrothermal metamorphism of uranium deposits; and hypergenesis in the uranium deposit oxidation zone. (tr-auth)

21777

A CLOSE INTERGROWTH OF URANINITE WITH A ZIRCONIUM MINERAL. V. I. Zhukova. Atonmaya Energ. 9, 52-4(1960) July. (In Russian)

The physical properties of uraninite containing zirconium do not differ from ordinary uraninite; the absolute hardness varies from 580 to 1070 kg/mm^2. The chemical properties of uraninite and results of x-ray analysis for zirconium and rare earths are tabulated. X-ray spectral analysis showed zirconium contents from a fraction of a percent to 10%; content of zirconium and rare earths in uraninite dolomites is larger than in uraninite schists. (R.V.J.)

21778

SYSTEMATIC MEASUREMENTS ON FALL-OUT IN THE YEAR FOLLOWING THE ENDING OF NUCLEAR WEAPONS TESTS. V. Santgol'zer. Atomnaya Energ. 9, 56(1960) July. (In Russian)

Systematic monitoring of fall-out indicated 121 μc/km^2 in April 1959 and 54 μc/km^2 in October 1959. Total activity the year following the ending of nuclear tests showed 104 μc/km^2. A sharp decrease in radioactive precipitation was observed during recent months. (R.V.J.)

21779

PROSPECTION FOR URANIUM IN THE PROVINCE OF TACNA. Bol. inform. junta control energía atómica (Peru) 5, 63-75(1960) May-June. (In Spanish)

The results of a preliminary prospection for uranium in the province of Tacna are reported. The zone studied was in the southwestern part of the province along the coast and the Caplina River. In this zone there are outcroppings of volcanic and intrusive rocks and, in a smaller quantity, sedimentary rocks represented by limestones and sandstones. In the radiometric examination readings from 0.03 to 0.05 mr/hr were found for the most part. This is the normal background for this type of rock. On the quartz seams the count varied from 0.03 to 0.07 mr/hr, rising to 2.00 mr/hr at one place in the principal level of the Cercana Mine. The types of mineralization were determined. (J.S.R.)

21780

COMPARISON OF SPECTRA OF AN EARTHQUAKE T-PHASE WITH SIMILAR SIGNALS FROM NUCLEAR EXPLOSIONS. Allen R. Milne. Bull. Seismol. Soc. Am. 49, 317-29(1959) Oct.

Hydrophones from a surface vessel in 1,300 fathoms of water off Juan de Fuca Strait detected, in the course of the "Hardtack" series of tests in the Marshall Islands, 3 acoustic signals which had peaks in their energy spectra at frequencies less than 20 cps. Two of these appear to have originated from nuclear explosions; the third, though having a similar energy spectrum, was apparently a T-phase from an earthquake near Cape Mendocino with its epicenter at 40°16'N., 124°12'W., and an original time of 23 : 04 : 46 on May 24, 1958. Travel-time measurements and signal spectra indicate that the nuclear explosions originated within Eniwetok Atoll. The coupling of their signals to the water path apparently was similar in nature to that of the earthquake T-phase, but the duration of the signals from the nuclear explosions was considerably less. (Geoscience Abstr. 2, No. 1, 1960)

21781

THE RESULTS OF ROUTINE OBSERVATIONS OF THE IONIZATION AND THE NATURAL RADIOACTIVE DUST CONCENTRATION IN THE ATMOSPHERE, IN TOKYO. (PRELIMINARY REPORT). Minoru Kawano and Sigeru Nakatani. Denki Shikensho Ihô 22, 535-46(1958).

The ionizations by α-, β-, γ-rays and by β-, γ-rays, and the natural radioactive dust concentration in the atmosphere near the ground were observed continuously at Tanashi, Tokyo, since April 1958. On fine days, the diurnal variation of the ionization by α-, β-, γ-rays is similar to that of the ionization by β-, γ-rays. The maximum value occurs at night (4 to 6 h), and the minimum value occurs in the daytime (11 to 13 h). On cloudy and rainy days, the time variations are very irregular, and the values are considerably larger than those on fine days. On fine days, the values of $(\beta,\gamma)/(\alpha,\beta,\gamma)$ are about 2 to 5 per cent, and is large in the daytime, and small at night; but, the values on cloudy and rainy days are considerably smaller than those on fine days. According to the results of observations with the electrical collector, the natural radioactive dust concentration is large at night and small in the daytime, and the diurnal course is similar to that of ionization. But, the amplitude of the diurnal variation curve of the dust concentration collected by the electrostatic collector is remarkably larger than that of the ionization by β-, γ-rays measured by the ionization chamber. The results of simultaneous observations mentioned above are seemed to be important for the researches of the natural radioactivity and the frequency distribution of the particle size of the radioactive dust in the atmosphere. The abnormal increase of the ionization by α-, β-, γ-rays was found during the solar eclipse, 19th, April, 1958. The maximum value occurred at the time of the maximum obscuration, and was over twice that on the other days. (auth)

21782

PARTICLE SIZE DISTRIBUTION OF RADIOACTIVITY OF THE NATURAL RADIOACTIVE DUST. Koji Kawasaki and Koji Kato. Denki Shikensho Ihô 22, 801-3(1958).

In order to provide information on the particle size distribution of the radioactivity of natural radioactive dust in the atmosphere near the ground, an apparatus was designed and the distribution of radioactivity was measured. The main part of the apparatus consists of the collecting system, detector, and counting system. The collecting system design is based on the results obtained from preliminary experiments that the polarity of particles is positive and the mobility of the particles scatters over a wide range. The system consists of the ion separator separating the particles in the airflow according to their mobilities and the electric precipitator to capture them. By the measurements, it was found that most of the natural radioactivity in the atmosphere attaches itself to particles having radii of 0.01 to 0.04 micron and the peak of the activity is in the vicinity of 0.0175 micron. (auth)

21783

ON THE RADIOACTIVE EQUILIBRIUM IN THE GRANITES

OF THE CENTRAL TIEN SHAN. I. E. Starik, L. Ya. Atrashenok, and A. Ya. Krylov. Doklady Akad. Nauk S.S.S.R. 132, 195-8(1960) May 1. (In Russian)

Direct determinations of U content in igneous rock were correlated with determinations based on Ra content. With U contents of (1 to 5) $\times 10^{-4}$%, results from the two methods were within 5 to 7%. With larger Ra contents, the accuracy was improved. Assays of mixed-rock and undisturbed granite samples indicate that U determination by Ra content is feasible. (R.V.J.)

21784

STATES OF URANIUM DETECTED IN BLACK SEA WATERS. L. B. Koliadin, D. S. Nikolaev, S. M. Grashchenko, Yu. V. Kuznetzov, and K. F. Lazarev. Doklady Akad. Nauk S.S.S.R. 132, 915-17(1960) June 1. (In Russian)

A carbonate complex of hexavalent uranium was found in a Black Sea layer between 0 to 2000 m. The data indicate the physico-chemical impossibility of uranium precipitation by reduction to the tetravalent state in the Black Sea hydrogen sulfide zone. (R.V.J.)

21785

RADIUM CONCENTRATION IN THE WATERS OF THE BLACK SEA. S. M. Grashchenko, D. S. Nikolaev, L. B. Kolyadin, Yu. V. Kuznetsov, and K. F. Lazarev. Doklady Akad. Nauk S.S.S.R. 132, 1171-2(1960) June 11. (In Russian)

Radium isotopes were separated from large volumes of water by radium and barium sulfate coprecipitation with iron hydroxide. The data indicate that the radium concentration is constant for the investigated Black Sea region. The mean concentration is $(1 \pm 0.1) \times 10^{-13}$ g/l, which is about the same as for ocean waters though the salinity of the Black Sea is two-fold less. However, the concentration of radium in river water emptying into the sea is comparably higher. (R.V.J.)

21786

SOME ASPECTS OF THE MARINE GEOCHEMISTRY OF URANIUM. Mitsunobu Tatsumoto and Edward D. Goldberg. Geochim. et Cosmochim. Acta 17, 201-8(1959) Nov.

The U concentrations in marine calcareous material of a biological origin varied between 0·0X and 0·X ppm, with the exception of corals which had concentrations of several ppm. The aragonitic oölites and aragonite precipitated from sea water had values similar to those of the corals. A geochronology based on the growth of ionium (Th^{230}) from U is applicable not only to corals, as previous investigators have pointed out, but also to oölites. Several examples of "oölite ages" are given. The U content of ferromanganese minerals from pelagic deposits is of the order of from 4 to 5 ppm. (auth)

21787

THE RELATIONSHIP BETWEEN THE PETROLOGY AND THE THORIUM AND URANIUM CONTENTS OF SOME GRANITIC ROCKS. J. M. Whitfield, John J. W. Rogers, and J. A. S. Adams. Geochim. et Cosmochim. Acta 17, 248-71(1959) Nov.

Th and U contents of granitic rocks are intimately related to modal compositions and general petrologic features. Correlations exist between Th content and common indices of general petrogenetic evolution, such as amount of dark minerals, percentage of anorthite in plagioclase, and ratio of K feldspar to plagioclase. Th content increases regularly toward the more acidic rocks, and the increase is most pronounced in the most highly alkaline samples. U content generally shows little, if any, relationship to modal composition or other petrologic features, and the increase in abundance of U toward the more acidic rocks is irregular. The greater petrogenetic control of Th than of U content may be explained on the basis of oxidation and repeated loss of U from magmas during the later stages of their differentiation. Such an explanation assumes that magmas are originally derived from a relatively homogeneous source; remobilization, however, of different types of sedimentary or other rocks might provide granitic magmas of widely different initial Th and U contents. The possibility that Th is added hydrothermally to granites is partly supported by unusually high abundance of Th in some red, porphyritic, allanite-bearing rocks, but the general petrologic control of Th abundances argues against major secondary addition of material. (auth)

21788

GEOCHEMISTRY VII. RECOVERY APPARATUS FOR TRITIUM IN NATURAL WATER. Ernst Schumacher (Universität, Zurich). Helv. Chim. Acta 43, 1019-32(1960). (In German)

An electrolytic method for separating T from natural water is described and discussed. (T.R.H.)

21789

RADIO-CARBON ANALYSIS OF OCEANIC CO_2. W. S. Broecker, C. S. Tucek, and E. A. Olson (Lamont Geological Observatory, Palisades, N. Y.). Intern J. Appl. Radiation and Isotopes 7, 1-18(1959). (In English)

Variations in the radiocarbon concentration of oceanic bicarbonate were studied for clues to large-scale ocean circulation patterns as well as to operation of the terrestrial CO_2 cycle. Samples for C^{14} analysis were processed aboard a research ship where CO_2 gas was stripped from 100 gal of acidified ocean water and absorbed in two small containers of KOH solution. In the laboratory the regenerated CO_2 was purified and its C^{14} activity was directly measured in one of two 5 l gas proportional counters. These were surrounded by 1 in. of mercury and an anticoincidence ring of 23 Geiger counters and permanently mounted within an iron shield 8 in. thick. Backgrounds approximated 15 counts/min; net contemporary counts were about 30 and 60 counts/min at one and two atmospheres filling pressure. Each sample was counted for at least two 1000 min periods. The results, representing over 100 deep and surface water samples, were expressed as per mil difference from a standard rather than in absolute units. For a given water mass, sample variations were consistent with those stemming from counting statistics alone (between 0.5 and 1.0%). By mass spectrometrically analyzing the C^{13}/C^{12} ratio of the CO_2 assayed for radiocarbon, corrections were made for isotopic fractionation during shipboard processing of the samples. (auth)

21790

INVESTIGATION OF U-CONTENT OF THE MORE IMPORTANT COAL FIELDS OF HUNGARY. Sándor Szalay, Gyula Almássy, László Pesty, and István Lovas. Magyar Tudományos Akad. Atommag Kutató Intézete (Debrecen), Közlemények 1, 7-26(1959). (In Hungarian)

A. Szalay and A. Földvári stated first in 1949 that some of the coal fields of the transdanubian part of Hungary showed an unexpected geochemical enrichment of U. A systematic investigation of the coal fields was made partly by radiometric means and partly by extended sampling and direct chemical analysis. Four coal fields are described: Ajka, Tatabánya, Mecsek Mountains, and Kisgyón. Radiometric and analytical methods are described and gave good agreement for the U content. The statistical distribution of U is represented on histograms. The average U contents are given for the different fields (about 60 g U/t coal). A

geochemical evaluation of the distribution is given in terms of A. Szalay's theory, according to which U was concentrated by the cation-exchange process on the humic acid content of fossile plant debris in the peat stage of coalification from very dilute solutions. (auth)

21791

INVESTIGATION OF THE URANIUM CONTENT OF COAL SAMPLES FROM DRILL HOLES IN THE COAL BASIN OF TATABÁNYA BY MEANS OF BETA RADIATION. Ádám Kovách. Magyar Tudományos Akad. Atommag Kutató Intézete (Debrecen), Közlemények 1, 27-30(1959). (In Hungarian)

The uranium content of 285 coal samples from drill holes in the region of the Tatabánya coal basin was determined by relative measurements with an end-window counter tube. The results were in accordance with those of measurements on the spot and laboratory chemical tests. Combustible shales of comparatively greater ash content as well as samples from the South-East and South-West of the basin were found the most active. Most of uranium is generally contained in the still strata. The measurements support the theory of uranium enrichment on humic substances. (auth)

21792

PRECISION INTERCOMPARISONS OF LEAD ISOTOPE RATIOS: BROKEN HILL AND MOUNT ISA. F. Kollar, R. D. Russell, and T. J. Ulrych (Univ. of British Columbia, Vancouver). Nature 187, 754-6(1960) Aug. 27.

A mass spectrometer was constructed and techniques were developed for the comparison of lead isotope ratios with a precision substantially better than previously studied. Samples from Broken Hill and Mount Isa, Australia, were measured. The values of lead isotope ratios obtained for each sample were much closer than those obtained by previous measurements and there was also a definite distinction between samples. The Broken Hill leads appeared to contain small amounts of radiogenic leads formed from an environment with a uranium–thorium ratio three times the mean crustal value. (M.C.G.)

21793

CRYSTALLOGRAPHIC STUDY OF ARTIFICIAL CARNOTITES. M. Jiménez de Abeledo, M. Rodríquez de Benyacar, and R. Poljak (Comisión Nacional de Energía Atómica, Buenos Aires). Publs. com. nacl. energía atómica (Buenos Aires) Ser. fis. 1, No. 14, 243-59(1957). (In Spanish)

Results are presented in the synthesis and crystallography of potassium–uranium vanadates (synthetic anhydrous carnotite). (W.L.H.)

21794

SOME URANINITES AND PITCHBLENDES FROM THE ARGENTINE REPUBLIC. C. E. Gordillo, E. Linares, and R. J. Poljak (Comisión Nacional de Energía Atómica, Buenos Aires). Publs. com. nacl. energía atómica (Buenos Aires) Ser. geol. 1, No. 1, 1-34(1957). (In Spanish)

Some uraninites and pitchblendes from the Argentine Republic were studied. The mineralogical and geological characteristics of the minerals and their known deposits in the Argentine are given. Microscopy studies, chemical analysis, and x-ray diffraction are included along with age calculations. (W.L.H.)

21795

DETECTION OF HEAVY ELEMENT ADMIXTURES IN MEDIA WITH SMALL ATOMIC NUMBER BY MEANS OF γ RAY LOGGING. A. F. Akkerman, P. L. Gusika, and D. K. Kaipov. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 124-30(1960). (In Russian)

Selective gamma well logging was studied with admixtures of 5% Al and 10% Pb. The spectra of forward and backward scattering are plotted. It is shown that the method can be applied for detecting small amounts of admixtures (up to 5%). Quantitative evaluation of the percentage of admixtures can be made by means of a luminescence spectrometer. (R.V.J.)

21796

FIELD TEST FOR BERYLLIUM. Waldemar M. Dressel and Roy Austin Ritchey. U. S. Bur. Mines, Inform. Circ. No. 7946. 5p. (1960).

A simple, reliable field test for Be in rocks was developed in which a small portion of the pulverized rock is fused with a sodium carbonate-sodium hydroxide flux in a wire loop. The fused mass is dissolved in water, a few drops of quinizarin solution are added, and the solution is viewed under ultraviolet light. A pink-to-orange fluorescence reveals the presence of Be in a sample containing as little as 0.013% Be (0.26% beryl). (auth) (Geo. Science Abstr. 2, No. 7, 1960)

21797

COMMENT ON THE AGE OF THE ELEMENTS. P. Eberhardt and J. Geiss (Universität, Bern). Z. Naturforsch 15a, 547(1960) May-June. (In English)

The excess of xenon isotopes, especially Xe^{131}, in the chondrite Richardton as compared to atmospheric xenon has been explained on the assumption that the xenon was produced inside the meteorite. This gave the maximum time between the synthesis of the elements and the formation of Richardton as 3.5×10^8 years. An alternative conclusion is given based on the assumption that all the excess xenon, including Xe^{129}, was trapped primeval gas from an atmosphere in which the decay of I^{129} contributed relatively more Xe^{129} than in the earth's atmosphere. On the basis of this assumption the time between nucleogenesis and meteorite formation may have been longer than 0.35×10^9 years. (J.S.R.)

21798

Geological Survey, Washington, D. C.

BERYL-BEARING PEGMATITES IN THE RUBY MOUNTAINS AND OTHER AREAS IN NEVADA AND NORTHWESTERN ARIZONA. Jerry C. Olson and E. Neal Hinrichs. Geological Survey Bulletin 1082-D. 1960. 71p., 3 ills. GPO.

Pegmatite occurs widely in Nevada and northwestern Arizona, but little mining was done for such pegmatite minerals as mica, feldspar, beryl, and lepidolite. Reconnaissance for beryl-bearing pegmatite in Nevada and in part of Mohave County, Ariz., and detailed studies in the Dawley Canyon area, Elko County, Nev., have shown that beryl occurs in at least 11 districts in the region. Muscovite has been prospected or mined in the Ruby and Virgin Mountains, Nev., and in Mohave County, Ariz. Feldspar was mined in the southern part of the region near Kingman, Ariz., and in Clark County, Nev. The pegmatites in the region range in age from Precambrian to late Mesozoic or Tertiary. Among the pegmatite minerals found or reported in the districts studied are beryl, chrysoberyl, scheelite, wolframite, garnet, tourmaline, fluorite, apatite, sphene, allanite, samarskite, euxenite, gadolinite, monazite, autunite, columbite-tantalite, lepidolite, molybdenite, and pyrite and other sulfide minerals. The principal beryl-bearing pegmatites examined are in the Oreana and Lakeview (Humboldt Canyon) areas, Pershing County; the Dawley Canyon area in the Ruby Mountains, Elko County, Nev.;

and on the Hummingbird claims in the Virgin Mountains, Mohave County, Ariz. Beryl has also been reported in the Marietta district, Mineral County; the Sylvania district, Esmeralda County; near Crescent Peak and near Searchlight, Clark County, Nev.; and in the Painted Desert near Hoover Dam, Mohave County, Ariz. Pegmatites are abundant in the Ruby Mountains, chiefly north of the granite stock at Harrison Pass. In the Dawley Canyon area of 2.6 square miles at least 350 pegmatite dikes more than 1 foot thick were mapped, and beryl was found in small quantities in at least 100 of these dikes. Four of these dikes exceed 20 feet in thickness, and 1 is 55 feet thick. A few pegmatites were also examined in the Corral Creek, Gilbert Canyon, and Hankins Canyon areas in the Ruby Mountains. The pegmatite dikes in the Dawley Canyon area intrude granite and metamorphic rocks which consist chiefly of quartzite and schist of probable Early Cambrian age. The granite is of two types: a biotite-muscovite granite that forms the main mass of the stock and albite granite that occurs in the metamorphic rocks near the borders of the stock. The pegmatites were emplaced chiefly along fractures in the granite and along schistosity or bedding planes in the metamorphic rocks. Many of the Dawley Canyon pegmatite dikes are zoned, having several rock units of contrasting mineralogy or grain size formed successively from the walls inward. Aplitic units occur either as zones or in irregular positions in the pegmatite dikes and are a distinctive feature of the Dawley Canyon pegmatites. Some of the aplitic and fine-grained pegmatite units are characterized by thin layers of garnet crystals, forming many parallel bands on outcrop surfaces. The occurrence of aplitic and pegmatitic textures in the same dike presumably indicates abrupt changes in physical-chemical conditions during crystallization, such as changes in viscosity and in content of volatile constituents. Concentrations of 0.1% or more beryl, locally more than 1%, occur in certain zones in the Dawley Canyon pegmatites. Spectrographic analyses of 23 samples indicate that the BeO content ranges from 0.0017 to 0.003% in the albite granite, from 0.0013 to 0.039% in aplitic units in pegmatite, from 0.0005 to 0.10% in coarse-grained pegmatite, and from less than 0.0001 to 0.0004% in massive quartz veins. The scheelite-beryl deposits at Oreana and in Humboldt Canyon, Pershing County, are rich in beryllium. Twelve samples from the Lakeview (Humboldt Canyon) deposit range from 0.018 to 0.11% BeO, but underground crosscuts have failed to intersect similar rock at depth. Beryl locally constitutes as much as 10% of the pegmatitic ore at Oreana. The beryl was not recovered during tungsten mining at Oreana and is now in the tailings of the mill at Toulon, Nev. The percentage of beryl is lower than the Oreana ore because of dilution by tailings from other ores milled at Toulon. Beryl was found in many pegmatite dikes in the Virgin Mountains. Both beryl and crysoberyl occur in dikes on the Hummingbird claims, north of Virgin Peak, in Mohave County, Ariz. Spectrographic analyses of 5 representative samples of the principal dike on the Hummingbird claims range from 0.055 to 0.11% BeO. (auth)

21799

Geological Survey, Washington, D. C.
URANIUM CONTENT OF GROUND AND SURFACE WATERS IN A PART OF THE CENTRAL GREAT PLAINS. E. R. Landis. Geological Survey Bulletin 1087-G. 1960. 40p., 1 ills. $0.50(GPO).

The uranium content of water from various rock units and geologic terranes has been determined in an attempt to locate areas in which large amounts of uranium in the water might indicate the presence of nearby accumulations of uranium in the rocks of the central Great Plains. Water samples were collected from three geologic terranes in the report area: The tuffaceous-rocks terrane, of Tertiary and Quaternary age: the shale terrane, of Cretaceous age; and the sandstone terrane, of late Permian through Early Cretaceous age. The average uranium content of 179 water samples from tuffaceous fluviatile rocks ranging in age from Pliocene to Pleistocene is 6.7 parts per billion (ppb). A total of 48 samples from Cretaceous shale and limestone of marine origin contain an average of 20.4 ppb uranium. Sandstone, siltstone, and claystone of terrestrial and nearshore marine origin are the predominant rocks of the sandstone terrane, and the 83 water samples collected from or related to these rocks contain an average of 10.2 ppb. The average uranium-content figure derived for the shale terrane may not be representative of the uranium content of waters from this unit throughout the report area because most of the samples were collected from a small area in which the uranium content of the waters may be abnormally large. Compared to the shale terrane, the tuffaceous-rocks terrane and the sandstone terrane are both represented by a greater number of samples collected over a much larger area, and the data on the average uranium content derived for them are believed to be representative of the uranium content in the report area. The data on average uranium content of the different rock units, or groups of rock units, are listed according to the source from which the samples were collected (well, spring, stream, municipal water system, reservoir, or lake), and for some samples by geographic parts of the report area. They are believed to be of more potential use in any future hydrogeochemical exploration in the area than are the data on average uranium content derived for the three geologic terranes. The average uranium content of ground-water samples from 12 individual rock units or groups of rock units ranges from less than 1.0 to 38 ppb. Several rock units were sampled over areas large enough to indicate that waters from the same rock unit in different parts of the report area may range widely in average uranium content. Most or all the water samples from certain rock units wherever present in the area, particularly those of Permian and Triassic age, contain large amounts of uranium. Also, relatively large amounts of uranium are present in water samples from some parts of the report area, such as the Cimarron River area of western-most Oklahoma and northeastern New Mexico, and the Rule Creek area of Bent and Las Animas Counties, Colo. Further exploration to determine the source of the uranium in the water from these rock units and areas may be worth while. (auth)

21800

Geological Survey, Washington, D. C.
PHOTOGEOLOGIC MAP OF THE CHACO CANYON-2 QUADRANGLE, McKINLEY COUNTY, NEW MEXICO. A. N. Kover. Miscellaneous Geologic Investigations Map I-315. 1960. 1p. $0.50(USGS).

21801

Geological Survey, Washington, D. C.
GEOLOGY AND THORIUM DEPOSITS OF THE WET MOUNTAINS, COLORADO. A PROGRESS REPORT. R. A. Christman, M. R. Brock, R. C. Pearson, and Q. D. Singewald. Geological Survey Bulletin 1072-H. 1959. 68p., 2 illus. GPO.

The McKinley Mountain area, a 22-square mile tract of Precambrian rocks that contain thorium-bearing veins, lies on the west flank of the Wet Mountains, Custer and Fremont Counties, Colo. The bedrock in this area is a complexly interlayered sequence of gneisses of metasedi-

mentary origin, migmatite, and granitic gneisses that has been transected by an albite syenite stock and numerous northwest-trending dikes, veins, and fractures. Hornblende-plagioclase and biotite-quartz-plagioclase gneisses are the principal metasedimentary rocks; garnet, sillimanite, quartzite, and pyroxene-scapolite zones are locally present. A poorly foliated alaskitic granite gneiss is common as layers ranging from more than 500 feet in thickness to migmatitic lit-par-lit type layers less than an inch thick. Of less wide distribution, but of similar occurrence, are quartz monzonite gneiss and light-colored granodiorite gneiss. The albite syenite, one of the youngest rocks in the area, is not foliated and is about 595 million years old (late Precambrian), by the Larsen zircon method of age determination. Many of the dikes are similar in composition to the albite syenite stock. The foliation of the gneisses generally is steep and trends northeast in most of the area. Several northeasterly trending folds were mapped in the northern half of the area; a vertically plunging fold occurs in the southwest quarter of the area. Faults, shear zones, and joints, some filled with veins and dikes, trend northwest across the area and cut the foliation at large angles. More than 800 radioactivity anomalies were found along northwesterly trending veins within the area, and 29 localities were examined outside the area. Most anomalies do not exceed 5 times the background count, but relatively rich concentrations of radioactive elements giving strong anomalies are scattered along the veins in pockets and lenses. The radioactivity, as shown by representative analyses, is due almost entirely to thorium. A hydrated thoritelike mineral is visible at some localities; the same mineral doubtless is finely disseminated among red, yellow, and brown iron oxides and (or) hydroxides at radioactive localities where no thorium-bearing mineral is visible. Besides iron oxides and, locally, thorium minerals, many veins contain abundant carbonate minerals, barite, quartz, and minor quantities of sulfide minerals. (auth)

HEALTH AND SAFETY

21802 AD-232429

Massachusetts Inst. of Tech., Cambridge.

APPLICATION OF WEATHER RADAR TO FALLOUT PREDICTION. Quarterly Technical Report No. 7 Covering Period from September 1, 1959 through November 30, 1959. Pauline M. Austin. Dec. 15, 1959. 15p. DA Project 3-99-07-102. Contract DA-36-039 SC-75030.

Applications of radar to the prediction of radioactive rainout resulting from a nuclear detonation are reported. It is recognized that precipitation particles scavenge radioactive dust in the atmosphere so that fall-out patterns are altered by the occurrence of rain and snowstorms. Since the precipitation exhibits significant small-scale variability the rainout amounts at any particular points may differ considerably from the average value for the general area. Because of lack of knowledge regarding mesoscale storm structure and the extent to which it may be predicted by either dynamic or statistical techniques an investigation was made of the distribution of precipitation as such, as well as its effect on the radioactive fall-out pattern. The work on instrumentation included completing the installation of the logarithmic receiver on the AN/CPS-9 radar and the modifications which permit the attachment to this radar of the delay-line integrator and signal-intensity contouring device. Installation of the digital counters on the R-meters was also completed. Attempts were made to follow up the direct measurements of transmitted power and beam patterns by checking the echoes received from standard targets. Two types are being investigated, both of which are expendable and can be attached to free balloons: a spherical balloon cover of metallized plastic and a six-inch aluminum sphere which can be placed inside the balloon. So far the results were not encouraging but efforts toward finding a suitable standard target will be continued. Observations of weather echoes were made on 27 days during the quarter. In several storms in addition to the various types of data previously taken, signal-intensity contours on the AN/CPS-9 radar were obtained. Most of the analytical work was aimed toward setting up a program for computing the distribution of radioactive fall-out from a megaton detonation as a function of both time and space in any given wind field. Methods of computing the effects of rain at any selected time and place are also being set up. The program is nearing completion and test runs will be started during the coming month. Work continues on the analysis of storm structure as shown on the contour data from the summers of 1958 and 1959 and also on the computation of the frequency spectra of turbulence in the atmosphere. (auth)

21803 AEET/AM/14

India. Atomic Energy Establishment, Trombay.

EVALUATION OF FUTURE LEVELS OF RADIOACTIVE FALLOUT. K. G. Vohra and U. C. Mishra. Feb. 1960. 22p.

The evaluations of future levels of strontium-90 deposition on the ground were calculated for three different cases. These assume that no more nuclear weapon tests are carried out after October 1958, that tests continue to be carried out at the same average rate as in the past, and that tests are carried out at the highest rate observed in the past, i.e., during the year 1958. These evaluations are done for Bombay, India, and are based on the ground deposition data on October 1, 1958, and stratospheric inventories due to injections in the equatorial and polar regions as given by Libby. For the first case the maximum level of ground deposition will be 28 mc/mi^2 and this value will be reached in 1963. The maximum values of ground deposition for the second and third cases are 152.7 mc/mi^2 and 438.7 mc/mi^2, respectively. The factors relating the ground deposition of strontium-90 to its concentration in the human bone were discussed, and the estimated concentrations of strontium-90 in the human bone are 4.8, 26.5, and 76 $\mu\mu$c strontium-90 per gram of bone calcium for cases one, two, and three, respectively. (auth)

21804 AERE-R-3165

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DESIGN AND CONSTRUCTION OF A LEAD SHIELDED CUBICLE FOR THE ANALYSIS OF $\beta\gamma$ ACTIVE MATERIALS. A. J. Fudge and M. F. Banham. Feb. 1960. Decl. May 9, 1960. 28p. BIS.

The modifications to four semi-shielded fume cupboards and a centrifuge alcove for the analysis of $\beta\gamma$ active materials in a laboratory are described. Three fume cupboards are used as the working area on highly active (up to 5 Mev curies) samples. One fume cupboard fitted with a sliding access door is also used as a decontamination bay. The alcove is used for unloading samples from shielded transport containers and for transferring samples to a balance box by means of a light railway. A shielded box was constructed containing a balance pan, the rest of the balance being unshielded for ease of access and maintenance. An electrically driven crane fitted with a manual lift was in-

corporated into the design so that sources, apparatus and reagents can be taken in and out of the working area. The apparatus necessary to carry out a number of standard analytical techniques is also described. (auth)

21805 CF-60-6-24
Oak Ridge National Lab., Tenn.
FUEL ELEMENT CATASTROPHE STUDIES: HAZARDS OF FISSION PRODUCT RELEASE FROM IRRADIATED URANIUM. G. W. Parker, G. E. Creek, W. J. Martin, and C. J. Barton. June 30, 1960. 87p. Contract [W-7405-eng-26]. OTS.

The rate of reaction of highly irradiated U with air, CO_2, and steam was studied in an investigation of the fission product release potential in a loss-of-coolant type accident postulated for Pu-producing reactors. Highly irradiated U was found to be more reactive, probably because of the defects in the oxide coating formed by the inclusion of fission products. Complete oxidation or melting was found to release rare gases, I, and Te semi-quantitatively in most atmospheres. Other fission products (Ru, Cs, and Sr) were released to a lesser extent and apparently in proportion to the amount of self-heating induced. In order of their relative tendency to release fission products, the atmospheric conditions investigated were rated in the order: air > CO_2 > steam. (auth)

21806 DP-473
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.
Sr^{90} MONITORING AT THE SAVANNAH RIVER PLANT. Frank E. Butler. May 1960. 38p. Contract AT(07-2)-1. OTS.

Radioassays of milk, soil, grass, and other material located near the Savannah River Plant showed no detectable Sr^{90} due to plant wastes. These assays indicated that the Sr^{90} found in this geographical area (25-mile radius of SRP) was nuclear weapons debris. Sr^{90} was separated from milk by absorption on cation exchange resin. An extraction technique was used in assaying Sr^{90} in all types of samples. Cs^{137}/Sr^{90} ratios were found to be constant in soil samples. (auth)

21807 HW-25457(Rev.2)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
MANUAL OF RADIATION PROTECTION STANDARDS. Mar. 1, 1960. 82p. Contract AT(45-1)-1350. OTS.

A manual of radiation protection standards is presented. These standards were written to aid in preventing ionizing radiation injuries to any individual, to control individual accumulated exposures to ionizing radiation, to limit exposures to the population around Hanford, and to minimize casual exposure of humans to ionizing radiation. (J.R.D.)

21808 HW-65534
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
EVALUATION OF RADIOLOGICAL CONDITIONS IN THE VICINITY OF HANFORD, JANUARY THROUGH MARCH, 1960. R. L. Junkins, E. C. Watson, I. C. Nelson, G. E. Backman, and R. C. Henle. May 31, 1960. 50p. Contract AT(45-1)-1350. OTS.

Data are tabulated on the concentration of radionuclides in the Columbia River, atmosphere, vegetation, and farm products during the period. The results indicate no apparent change in the estimated annual dose to the various organs of persons in the neighborhood. Analytical methods for determining radionuclide concentrations in various types of samples are appended. (C.H.)

21809 LA-2425
Los Alamos Scientific Lab., N. Mex.
NEUTRON TISSUE DOSE SURVEY FOR THE LITTLE EVA CRITICAL ASSEMBLY. Morris J. Engelke, Bruce B. Riebe, and J. A. Sayeg. Apr. 1960. 15p. Contract W-7405-eng-36. OTS.

A neutron tissue dose survey was made for the Little Eva critical assembly using the Hurst neutron proportional counter. Comparisons were also made with the Los Alamos "Converted Pee Wee" neutron counter. The data indicated the Pee Wee counter measurements to be a factor of 7 higher than those obtained with the Hurst counter. This difference in the measurements is mainly attributed to an "over response" of the Pee Wee (on a dose per neutron basis) in the intermediate and thermal neutron energy region. (auth)

21810 NP-8736
Arizona. Univ., Tucson. Inst. of Atmospheric Physics.
EVALUATION OF POTENTIAL VORTICITY CHANGES NEAR THE TROPOPAUSE, AND THE RELATED VERTICAL MOTIONS, VERTICAL ADVECTION OF VORTICITY AND FLOW OF RADIOACTIVE DEBRIS FROM STRATOSPHERE TO TROPOSPHERE. Scientific Report No. 14. D. O. Staley. Mar. 26, 1960. 60p. Contract Nonr-2173-(02).

Individual potential vorticity change, vertical motion, vertical advection of vorticity, and flow from stratosphere to troposphere were evaluated at different levels and for different times in an extratropical disturbance. (auth)

21811 TID-6202
Columbia Univ., Palisades, N. Y. Lamont Geological Observatory.
PROJECT SUNSHINE ANNUAL REPORT [FOR] PERIOD OCTOBER 1, 1957—SEPTEMBER 30, 1958. Oct. 30, 1958. 226p. Contract AT(30-1)-1956. OTS.

The objective of Project Sunshine was to define the concentration and distribution of strontium-90 in the human environment. The annual increment of strontium-90 concentration in man was defined for a four-year period for the New York City population group. Through use of bone data and by extrapolations from data on soil, food, and rainfall the distribution of strontium-90 in the world population was estimated. The dietary level of strontium-90 was defined for the United States through data from the analyses of milk from the principal milksheds as well as other vegetable and cereal foodstuffs from many areas. The human radium burden was also determined. Published papers and manuscripts are included. Pertinent unpublished data are tabulated. (C.H.)

21812 CEA-tr-A-466
RECHERCHES EXPÉRIMENTALES SUR LA DÉCONTAMINATION DE L'EAU, EN VUE DE LA PRÉPARATION D'EAU POTABLE À PARTIR D'EAUX ARTIFICIELLES CONTAMINÉES (PARTIE I). (Experimental Research on Decontamination of Water. Preparation of Potable Water from Artificially Contaminated Water. (Part 1). E. H. Graul and E. K. Reinhardt. Translated into French from Atompraxis 4, 397-402(1958). 18p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 4607.

21813 JPRS-5030(p.7-34)
EXPERIENCE IN DOSIMETRIC CONTROL AND DISPENSARY CARE OF WORKERS IN THE LABORATORY OF NUCLEAR PROBLEMS (OF THE UNITED INSTITUTES OF NUCLEAR RESEARCH). V. P. Afanas'ev (Afanas'yev),

V. A. Golovina, M. M. Komochkov, V. N. Mekhedov, K. O. Oganesyan, V. Ye. Rozhkov, A. M. Rozanova, and M. N. Fateeva. Translated from Med. Radiol. 5, No. 1, 6-18 (1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8629.

21814 JPRS-5030(p.113-21)
DOSIMETRY IN X-RAY DIAGNOSTIC EXAMINATIONS OF CHILDREN. G. N. Apasov. Translated from Med. Radiol. 5, No. 1, 46-50(1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8630.

21815 JPRS-5030(p.127-40)
PHYSICAL PRINCIPLES IN THE SELECTION OF A METHOD OF β-IRRADIATION. K. K. Aglintsev and V. P. Kasatkin. Translated from Med. Radiol. 5, No. 1, 52-8 (1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8631.

21816 JPRS-5030(p.146-60b)
PRINCIPAL PROBLEMS OF LABOR HYGIENE IN MINING RADIOACTIVE MINERALS. A. V. Bykhovskii (Bykhovskiy). Translated from Med. Radiol. 5, No. 1, 60-6(1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8632.

21817 JPRS-5030(p.161-77)
THE DISTRIBUTION OF RADIOACTIVE CONTAMINATION IN A STAGNANT RESERVOIR. A. L. Agre and V. I. Korogodin. Translated from Med. Radiol. 5, No. 1, 67-73 (1960).

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 8633.

21818
DECONTAMINATION OF HUMAN SKIN EXPERIMENTALLY SOILED BY RADIOACTIVE MATERIALS. Jean Spencer Felton and C. John Rozas (Univ. of California, Los Angeles). Arch. Environmental Health 1, 87-95(1960) Aug.

An investigation was made of the efficiency of a series of cleansers both of the granular and waterless variety, plus a slurry and a special cream, in the decontamination of radioactivity on the skin, utilizing as laboratory soil the radioactive isotopes of I^{131} and P^{32}. The test materials, in the quantities used, provided 0.05 μc. in an alcoholic solution per application. The removal of radioactive contaminants on the skin was effected with a high degree of efficiency, (99.6%) in the case of P^{32} and 99.0% for I^{131}. With the additional terminal wash by the subjects with granular cleanser uncontrolled by time, the amount of contaminant removed was essentially 100%. The granulated skin cleanser was superior to the waterless cleaner in effecting decontamination and a remarkably better agent than two commonly used for this purpose. In view of the high percentages of removal of the radioactive soil by the granular cleanser, it is recommended for use in both laboratory and industrial operations involving contamination of the skin by radioactive materials. In areas where water is not available, waterless hand cleansers can be utilized and should remove approximately 97% to 98% of the contamination. The protection offered by silicone and lanolin lotions was not of significance. No untoward effects were encountered from the use of these cleansing materials in the test situations described. (auth)

21819
QUANTITATIVE DETERMINATION OF THE FISSION PRODUCTS DEPOSITED IN THE NORTH ALPINE REGION. K. Pötzl and R. Reiter (Physikalisch-Bioklimatisch Forschungsstelle, Munich). Atomkernenergie 5, 285-7 (1960) July-Aug. (In German)

Data are tabulated on the fission products in air, soil, plants, and animals of the Northern Alps. The distribution with altitude is discussed with respect to a mechanism for partition of radioactive material from different sources and different properties in the lower atmosphere. (T.R.H.)

21820
RELATION OF RADIATION DOSE TO ABSORBED DOSE. Yu. V. Sivintsev. Atomnaya Energ. 9, 39-47(1960) July. (In Russian)

The difference between the concept of "radiation dose" and absorption is analyzed and formulas are offered for absorption dose calculations using the results of absolute measurements of radiation dose. Conditions of electron equilibrium in dosimetric measurements of x and γ radiation at various energy ranges from 200 kev to 32 Mev are described. (tr-auth)

21821
EXACT MEASUREMENTS OF THE CONCENTRATIONS OF RADIOISOTOPES OF LEAD AND BISMUTH IN THE AIR OF UNDERGROUND WORKINGS. V. I. Baranov and L. V. Gorbushina. Atomnaya Energ. 9, 56-7(1960) July. (In Russian)

A radiochemical method of separately determining lead (RaB and RaD) and bismuth (RaC and RaE) in aerosols collected with a special filter is suggested as a control measure in underground mining. Time variation curves plotted for RaD (E = 0.0167 Mev) and RaE β activity indicate a half life close to five days for RaE. The time variation curves for RaB (T = 26.8 min) and RaC (T = 19.7 min) obtained after filtering 400 l of air showed good half life separation and permitted an evaluation of the number of RaB and RaC atoms in the air and in the filter. (R.V.J.)

21822
THE α-RAY DOSE RATE NEAR AN INTERFACE BETWEEN DIFFERENT MEDIA. G. A. Volkov and G. R. Rik. Biophysics (U.S.S.R.) (English Translation) 5, 60-9(1960).

Formulas are presented for use in calculating the alpha dose rate near an interface between different media. Differences in stopping power of the media, isotope content, and nature of the isotope are considered. Flat, cylindrical, and spherical interfaces are considered. (C.H.)

21823
CONTAMINATION PROTECTION SUITS FOR WORK IN RADIOACTIVELY CONTAMINATED SURROUNDINGS. S. Krawczynski and A. Meixner (Kernreaktor Bau- und Betriebs-Gesselschaft m.b.H., Karlsruhe, Ger.). Kerntechnik 2, 231-3(1960) July-Aug. (In German)

Two contamination protection suits which permit work in contaminated surroundings and in the presence of radioactive aerosols are described. One is an English suit being manufactured commercially and the other is a newly developed German suit. The German model is distinguished by mechanical stability, chemical resistance, fireproofness, and aerosol tightness. A special suit opening permits the suit to be put on and off without the assistance of a second person. (tr-auth)

21824
PRACTICAL DETERMINATION OF PERSONAL DOSE WITH PHOTOGRAPHIC EMULSIONS IN X-RAY, ISOTOPE, AND REACTOR OPERATIONS. H. Dresel (Universität, Freiburg 1. B.). Kerntechnik 2, 239-44(1960) July-Aug. (In German)

The preparation and radiation characteristics of film badges for radiation and neutron dose measurements are reported. (J.S.R.)

21825

COMPARISON OF FISSION PRODUCT AND BERYLLIUM-7 CONCENTRATIONS IN THE ATMOSPHERE. W. Anderson, R. E. Bentley, R. P. Parker, J. O. Crookall, and L. K. Burton (Royal Cancer Hospital, London). Nature 187, 550-3(1960) Aug. 13.

Measurements of the γ activity of atmospheric dust collected from surface air by an electrostatic precipitator at Sutton, Surrey, were made since May 1959. Resolution of the energy spectra revealed three peaks at 0 43, 0.476, and 0.515 Mev, which are ascribed to Sb^{125}, Be^{7}, and Rh^{106}, respectively. Sb^{125} and Be^{7} were subsequently identified by chemical carrier and counting methods; Rh^{106} and Sb^{125} are fission products, while Be^{7} is produced by cosmic radiation. Their concentrations are compared with results of various fission reactions; the ratios of fission product to Be^{7} are found to remain relatively constant. (D.L.C.)

21826

THE BEHAVIOR OF FISSION PRODUCTS OF DIFFERENT PERIODS IN AEROSOLS OF THE LOWER ATMOSPHERE. R. Reiter (Universität, Munich). Naturwissenschaften 47, 300-1(1960). (In German)

At two different Alpine stations, one in a valley and the other on a mountain with a vertical distance of 2.5 km, radioactive aerosols were collected and the ratio of long-lived β components to the total activity was determined. Monthly results from April 1959 to March 1960 are diagrammed. A comparison of the total activity, long-lived activity, temperature gradient, and air pollution at the two stations led to the following conclusions. Radioactivity measurements at the mountain station yield significant contributions to the estimation of the results obtained at the valley station. The quantity of the long-lived elements in the aerosols gives no concrete conclusions on its possible direct removal from the stratosphere to the surface of the earth since more long-lived elements are repeatedly whirled up from the earth's surface than stream in from the higher atmosphere. From the repeated whirling up of long-lived radiators in the lowest air layer an additional radiation charge results directly from the biologically effective Sr^{90} and Cs^{137}. (J.S.R.)

21827

FINDINGS OF A SURVEY OF X-RAY UNITS. Oregon's Radiological Health Program. Walter R. Stahl, Ralph R. Sullivan, and David G. Wagstaff (Univ. of Oregon, [Portland]). Public Health Repts. (U.S.) 75, 652-8(1960) July.

A field survey of x-ray units used by all types of practitioners for diagnostic work was made in Oregon during 1958 and 1959. Results of this survey, along with a summary of the efficacy of steps that can be taken to protect the population from unnecessary exposure, are presented. (auth)

21828

DECONTAMINATION AND POTABILIZATION OF THE RIO DE LA PLATA'S WATER AFTER A NUCLEAR EXPLOSION. Leopoldo Jose Anghileri. Publs. com. nacl. energía atómica (Buenos Aires) Ser. quim. 1, No. 12, 141-88(1957). (In Spanish)

Decontamination values were determined (decontamination factor and percentual decontamination), for different isotopes using the potabilization process of Obras Sanitarias de la Nación with Rio de la Plata's waters. The decontamination efficiencies of the different processes in the case of contamination through fission products and through activation of said water then were compared. By means of a small pilot plant, a process finally was tested applicable to Obras Sanitarias de la Nación in the event a contamination caused by nuclear fission may occur. (auth)

21829

AN IDEA ON THE MAXIMUM PERMISSIBLE CONCENTRATION OF RADIO-ACTIVE MATERIALS IN SEA-WATER. Yoshio Hiyama (Tokyo Univ.). Records Oceanog. Works Japan 5, 98-104(1960) Mar.

Relationships between the level of sea-water contamination by several radioactive materials and the level of radiation dose-rate inside the human body caused by these materials were studied. For some elements the average amount of daily intake per person and the fraction of it that originates from sea water or marine organisms are known. If the concentration of that element in sea water is also known, the sea water equivalent for daily human intake can be determined. If this value for sea water equivalent is divided into the maximum permissible amount for daily human intake for that element, then the maximum permissible concentration of that radionuclide in sea water is obtained. The maximum permissible concentration in sea water was calculated for several isotopes by this method. (M.C.G.)

21830

UNDESIRABLE RADIOIODINE INHALATION AND ITS PREVENTION. Konrad Hennig (Strahlenklinik der Medizinischen Akademie, Dresden). Strahlentherapie 112, 462-6(1960) July. (In German)

The incorporation of radioiodine (I^{131}) by the personnel of a medical isotope department is reported. The experiments demonstrate that from radioiodine solutions, as they are used for medical purposes, a considerable amount evaporates and causes undesirable incorporation by inhalation. For the prevention of the evaporation of radioiodine the admixture of sodium bicarbonate is recommended. (auth)

21831

RADIATION SAFETY AND HAZARDS IN NUCLEAR ENERGY. John H. Lawrence and Howard G. Parker (Univ. of California, Berkeley). p.101-9 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Various aspects of safety in the peaceful use of nuclear energy are reviewed. The experience of the AEC from 1945 through 1958 is reviewed. During this period there were 15 reported radiation accidents resulting in lost-time injuries involving 36 individuals. There were four deaths, three of which were from supercriticality accidents. A review of the accidents shows that nuclear criticality safety is a very complex thing. The long-term damaging effects of small radiation exposures must also be guarded against. Safety procedures during medical uses of radioisotopes and the role of the health physicist are also discussed. (C.H.)

21832

United States. Congress. Joint Committee on Atomic Energy.
SELECTED MATERIALS ON RADIATION PROTECTION CRITERIA AND STANDARDS: THEIR BASIS AND USE. JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, MAY 1960. 1261p. GPO.

Background reference materials are presented on radi-

ation protection criteria and standards. The information was collected for use by the Joint Committee on Atomic Energy of the Congress of the United States during hearings scheduled for May 1960 on Radiation Protection Criteria and Standards: Their Basis and Use. An outline of the proposed hearings is included. Recent reports and papers relating to radiation protection criteria and standards are included. Statements are also included by private groups and individuals, the U. S. Naval Radiological Defense Laboratory, the Air Force Special Weapons Center, the Atomic Energy Commission and its contractors, the Department of Health, Education, and Welfare, the Department of Defense, and other Federal agencies. Included are 296 references to reports and published literature on radiation protection standards written since 1957. (C.H.)

21833

THE PROTECTION OF WORKERS AGAINST IONISING RADIATIONS. Report IV (1), Forty-fourth Session, International Labour Conference, 1960. Geneva, International Labour Office, 1959. 34p. $0.30. (In English)

The texts of a proposed convention of supplementary recommendations for the protection of workers against the harmful effects of ionizing radiations are presented. The texts are based on the conclusions reached by the Committee on Radiation of the International Labor Conference, meeting at Geneva, June 1959. The texts were prepared as a basis for discussions by the Conference at its next session. (C.H.)

21834

RADIOACTIVITY WARNING APPARATUS. Hugh Arthur Staines (to Barcross, Ltd.). British Patent 838,144. June 22, 1960.

The design of a radioactivity warning apparatus for detecting and indicating a rise in the level of radioactivity in gas-borne dust is presented. The apparatus consists of a filter, a means for passing the gas through a filter at a constant rate, a detector for radiation emitted by particles trapped in the filter, and an indicating means adapted to be actuated by a rise in the intensity of radiation detected by the detector. (W.L.H.)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

21835 AD-231623

California. Univ., Davis.

STUDIES ON PHYSICAL AND CHEMICAL MODIFICATION OF PROTEINS FOR THE PREVENTION OF IRRADIATION OFF-FLAVORS IN MEAT. Report No. 3 (Annual) for the Period May 15, 1958—May 15, 1959. A. L. Tappel. 20p. Project No. 7-84-01-002. Contract DA19-129-qm-1172.

Results are reported from a number of experiments assessing the effects of radiation on the odor and chemistry of egg albumin solutions. Progress is reported in experiments dealing with the effects of radiation on glutathione and α-tocopheral. (C.H.)

21836 AD-232782

Kansas State Univ., Manhattan.

DETERMINATION OF THE FEASIBILITY OF PRODUCING NON-STALING BREAD-LIKE PRODUCTS. Report No. 6 (Progress) for the Period March 15, 1959—May 15, 1959. John A. Johnson and Donald Miller. 9p. Project No. 7-84-06-032. Contract DA19-129-QM-1119.

Fatty acids, including myristic, palmitic, and oleic acids, used in concentrations of 1% caused the bread stored for 4 days to be softer than untreated bread. Superimposing bacterial alpha-amylase also assisted in maintaining softer crumb. Fatty acids have little effect on the hot paste viscosity but do affect the cooling cycle viscosity. Modified starches have not proven satisfactory for use in bread production. Irradiation of the starch with gamma rays reduced the baking value. (auth)

21837 AD-233475

West Virginia Pulp and Paper Co., Tyrone, Penna.

STUDIES TO DETERMINE OPTIMUM CHARACTERISTICS OF IN-PACKAGE ACTIVATED CHARCOALS FOR REMOVAL OF IRRADIATED FLAVOR DURING STORAGE. Report No. 5 (Progress) [for] April 10, 1959 to August 9, 1959. Henry F. Laughlin. 10p. Project No. 7-84-01-002. Contract DA-19-129-QM-1212.

Results are reported from a study of the physical properties of samples of activated charcoal of interest as means of removing off-flavors from irradiated canned foods. Data are tabulated. (C.H.)

21838 JLI-650-1-3

Johnston (William H.) Labs., Inc., Baltimore.

SHORT COURSE IN BASIC AND APPLIED ISOTOPE TECHNOLOGY DEVELOPED FOR U. S. ATOMIC ENERGY COMMISSION OFFICE OF ISOTOPES DEVELOPMENT. Final Report. R. W. Kiser, A. F. Findeis, H. M. Rosenstock, N. W. Desrosier, and W. H. Johnston. June 1959. Includes reprint: LOW-LEVEL COUNTING METHODS FOR ISOTOPIC TRACERS. W. H. Johnston. Science 124, 801-7 (1956). 219p. Contract AT(11-1)-650. OTS.

A proposed list of lectures and laboratory experiments and an outline for a six-week course in basic and applied industrial isotope technology are presented. The course is directed toward participants with at least the equivalent in training or experience of an M.S. degree in chemistry or physics. The course is designed to give a broad, basic review of fundamental theory integrated with examples and principles of application to industrial problems of research, development, control, and manufacturing. (C.H.)

21839 NP-8888

Massachusetts Inst. of Tech., Cambridge. Div. of Industrial Cooperation.

EVALUATION-DEVELOPMENT OF THE CONCURRENT RADIATION DISTILLATION. Report No. 12 (Final) [Covering the] Period April 21, 1957 to April 30, 1959. B. E. Proctor. 88p. Project No. 7-84-01-002. Contract DA-19-129-QM-905.

A radiation distillation apparatus which attains high dose rates by means of high-energy electrons was designed and constructed. Modifications were made to the apparatus to allow isolation of the volatile components produced during radiation-distillation. The use of the concurrent radiation-distillation technique was employed for characterizing the volatile flavor compounds from irradiated beef slurries and from milk. The effect of process variables on the storage qualities (browning and gelation) of radiosterilized milk was studied. The conditions necessary to accomplish inactivation of proteolytic enzymes in beef muscle were investigated. (C.J.G.)

21840 ORO-305

North Carolina State Coll., Raleigh. Textile Research Center.

APPLICATIONS OF NUCLEAR RADIATION AND RADIOISOTOPES TO TEXTILE MATERIALS AND PROCESSES. Annual Report for the Period November 1, 1958 to November 1, 1959. 72p. Contract AT(40-1)-2477. OTS.

The rate at which textile materials were changed by gamma irradiation was determined. Radiation effects on

strength and elongation of rayon, acetate, Dacron, nylon 66, Orlon, polypropylene, wool, and silk were studied. All the materials except Orlon, Dacron, and wool were adversely affected by gamma radiation in relatively short periods of time. Radiation effects on monomers showed the following: (1) water accelerated the rate at which the monomer was polymerized; (2) acrylonitrile, vinyl acetate, and styrene polymerized the most readily; (3) the presence of organic solvents in some cases apparently inhibited the polymerization of the monomer; and (4) the presence of oxygen seriously inhibited the polymerization of most of the monomers. Experiments were conducted in an attempt to show the usefulness of a beta gage to monitor drying, wet-processing, and weight of various fabrics and weight losses in abrasion instruments. (C.J.G.)

21841

FINDING PIPING LEAKS WITH SEALED MILLICURIE FLOATS. Robert E. Black and Walter Kerwick (General Motors Research Labs., Warren, Mich.). Nucleonics 18, No. 8, 106-8(1960) Aug.

A method is described in which a sealed radioisotope-tagged float is used to find leaks in piping which runs under concrete floors or fills. The current caused by the leak causes the float to seek out the leak. Early studies with this method employed a sponge-rubber ball as a float. Spun stainless steel balls are being put to use, due to their pressure-change insensitiveness. The nuclides used for float marking were Co^{60} and Na^{24}. (B.O.G.)

21842

THE POTENTIAL AND APPLICATION OF THE SYNTHETIC RADIOACTIVE ISOTOPE IN VACUUM RESEARCH AND TECHNOLOGY. Luther E. Preuss (Edsel B. Ford Inst. for Medical Research, Detroit). p.114-24 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In English)

A brief outline of the uses, to date, of the radioactive nuclide in basic vacuum research and routine technological application, illustrates that the tracer tool's initial emphasis, in vacuum work, has been predominately in the realm of the distillation phenomena. Some examples of the radiotracer system applied to vacuum evaporation of nuclides, are given. The modes of availability for synthetic radioactive isotopes are reviewed, along with the restrictions imposed on their use in vacuum study by their characteristics of half-life, radiation type, specific activity, etc. The methodology and some examples of health-physics procedures, vacuum system alteration, and essential techniques of radiotracer work are dealt with, along with usefulness of ancillary techniques, such as the autoradiographic method. A brief critique is made for the potential of the radiotracer technic, and its attendant sensitivity, for specific vacuum studies. (auth)

21843

International Atomic Energy Agency, Vienna.
LARGE RADIATION SOURCES IN INDUSTRY. VOL. 1. CONFERENCE PROCEEDINGS, WARSAW, 8-12 SEPTEMBER 1959. 1960. 482p. $4.50.

Thirty-four papers are included; separate abstracts have been prepared for thirty-three. An abstract of the remaining paper appeared previously in NSA. (D.E.B.)

21844

A MOBILE IRRADIATOR DESIGN STUDY. F. G. Rice, R. Courtemanche, and J. Masefield (Atomic Energy of Canada, Ltd., Ottawa). p.3-13 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

A design and cost study of a mobile irradiator was made to collect data on the feasibility of commercial potato irradiation using cobalt-60 gamma rays. Investigation of handling and storage of potatoes in major growing areas in Canada and the United States showed that the irradiator should process at least 6,000 lb. per hour in bulk or in 100-lb bags. Tests on irradiated potatoes indicated that a dose of 8,000 rads would effectively inhibit sprouting at a storage temperature of 68°F. Based on source configurations of other AECL irradiation facilities, calculations and measurements of dosage uniformity were made showing that ±33 per cent variation occurred when using two passes on each side of the line source. The source was designed to have increased activity near the ends. The calculated radiation utilization efficiency was 48 per cent. A truck-mounted irradiator was studied and found to be too heavy for easy transportation. An irradiator using a railroad flatcar and weighing 60 tons was then considered because most potato warehouses are located near railroad sidings. The processing cost including depreciation, source replacement, and operating costs, was estimated to be 0.9 per cent per lb for 1,200 hours operation per year. A longer operation time per year results in a decrease in this processing cost. The above figure is based on estimated costs for a prototype unit. Somewhat lower costs are indicated for production irradiators. (auth)

21845

THE MAIN TECHNOLOGICAL CHARACTERISTICS OF APPARATUS FOR INDUSTRIAL RADIOCHEMICAL PROCESSES, IN PARTICULAR ETHYLENE POLYMERIZATION. N. P. Syrkus, A. Kh. Breger, and B. I. Vainshtein (Karpov Physiochemical Inst., Moscow). p.15-30 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In Russian)

A general review is presented of some of the main technological features of apparatus, for instance spherical apparatus, for industrial radiochemical processes. A method is proposed for estimating the effectiveness of apparatus of any given construction by comparing it with the output of an infinitely large apparatus having the same radiation source. An account is given of the technological features of an apparatus for radiopolymerizing ethylene at 200 atmospheres and 25°C with a rodshaped gamma-radiation source (Co^{60}) of variable activity. This apparatus can be designed to suit the mean dose rate which the power efficiency of the apparatus allows. It is shown that the yield Q of the apparatus is a constant ratio of the power W_0 of the gamma radiation of the apparatus. In the apparatus reviewed, $Q \sim W_0^{0.5}$. (auth)

21846

THE TECHNOLOGY AND APPLICATIONS OF LARGE FISSION PRODUCT BETA SOURCES. Joseph Silverman (Radiation Applications, Inc., New York). p.31-53 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

About four years ago, it became apparent that a broad field of potential applications involving surface radiation treatment was developing, e.g., surface modification of formed plastics by graft copolymerization and surface

pasteurization of food. For these applications, penetration in depth is wasteful and potentially harmful. There are two other areas for which machine electrons were not well suited: radiation-induced chemical syntheses in pressure vessels, and certain types of free radical chain reactions for which the production rate per kilowatt decreases with the square root of the dose rate. Broad area beta sources showed obvious potential advantages in all these categories and, since they are available in good yield from the fission process, merited a careful reappraisal. A study of the applications and technology of fission product beta sources was performed. The results indicate the following: (1) There are promising areas for commercial application of fission product beta emitters in the radiation processing field, particularly in the graft copolymerization modification of formed plastic surfaces and textiles. (2) Massive, rugged, inert, safe, inexpensive beta sources may be fabricated by suitable extensions of existing techniques. Source-bearing glass formulations show particular promise. (3) Beta absorption calculations indicate that extended sources can be designed with power utilization efficiencies as high as 20 per cent. Equations and curves describing dosage and beta utilization efficiency as a function of the geometry and composition of various source-target systems were developed. (4) An engineering cost analysis indicates that fission product beta power can be competitive with alternative sources of radiation. (auth)

21847

EXPERIMENTAL PARAMETRIC STUDY OF LARGE-SCALE Co^{60}, Na^{24}, AND Cs^{137} SLAB IRRADIATORS. B. Manowitz, O. A. Kuhl, L. Galante, R. H. Bretton, and S. Zwickler (Brookhaven National Lab., Upton, N. Y.). p.65-91 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Target parameters include capacity (energy input per unit mass per unit time), residence time, minimum dose required, maximum dose variation permitted, target dimensions, and target density and composition. Source parameters include source composition (photon energy, source density, and atomic number), total activity (curies), average specific activity, activity distribution, source dimensions, and source-to-target geometry. Large-scale slab sources of low activity level of Co^{60}, Na^{24}, and Cs^{137} were assembled. The Co^{60} was in the form of cobalt metal, sp. gr. 8.9, the Na^{24} was in the form of a dilute aqueous solution of Na_2CO_3, sp. gr. 1, and the Cs^{137} was in the form of a compressed solid composed of a homogenous mixture of Cs^{137} Cl and $BaSO_4$, sp. gr. 2.7. Several static finite slab targets of paraffin wax were used in all experiments. Measurements were made with calibrated instruments of the exposure dose at many points in the target delivered over known periods of time. The specific activity and total activity of the source materials were determined by radiochemical analysis. Source and target parameters, including source dimensions, source activity distribution, and source-to-target geometry, were varied in such a way as to obtain information on specific dose rate and dose distribution in the target. Various absorbers between source and target were also studied. For calculation purposes, the finite source was divided into a number of line elements. Using the uncollided flux equation with the NDA-NBS build-up factor modified for finite media, the contribution of each element to various points in the target was calculated. The conformity of the experimental data to the theoretical is discussed. The data were applied to a set of specifications and for a particular design a comparison is made between available Co^{60}, Na^{24}, and Cs^{137} sources. (auth)

21848

GAMMA RADIATION FACILITIES AT THE AUSTRALIAN ATOMIC ENERGY COMMISSION RESEARCH ESTABLISHMENT. D. W. George and J. N. Gregory (Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales, Australia). p.95-103 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The used fuel elements from the AAEC experimental reactor HIFAR are to be stored on removal from the reactor for a period of about 40 days in a water-cooled storage cell. During this period, the gamma activity and thermal heating will fall by a factor of about ten. The average gamma activity of each fuel element during storage is about 10^5 curies. The fuel elements will be stacked vertically during storage in a regular square pattern with a total of 48 positions at 7-in. pitch. The centre position has been substituted by an irradiation thimble 9 in. in diameter and is closely surrounded by eight symmetrically placed fuel element positions. The experimental irradiation space is a volume about 7 in. in diameter and 2 ft. 6 in. long. Material for irradiation is to be attached to a shielding plug and will be introduced into and moved from the thimble by the reactor vertical handling flask. The shielding plug has a number of access tubes which will permit heating or cooling of the irradiated material, temperature measurement, control of atmosphere, and withdrawal of liquid or gaseous reaction products. The extra expense of adding this unit to the storage cell was very small and since it uses the radiation from the fuel elements during compulsory storage, radiation costs are virtually zero. The radiation facilities available directly from HIFAR and plans for using fuel elements after cropping as a further radiation source are described. (auth)

21849

PLANT FOR THE TECHNOLOGICAL STUDY BY IRRADIATION OF RUBBER AND PLASTICS, EMPLOYING A COBALT-60 RADIATION SOURCE. Josef Šimorda (Rubber and Plastics Technological Research Inst., Gottwaldov, Czechoslovakia). p.105-14 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In Russian)

Plans are described for a plant for the study of rubber vulcanization by irradiation, employing 2,000-curie cobalt sources. A detailed examination is made of the manner in which the eight radiation emitters (of 250 curies each) can best be arranged, providing uniform distribution of irradiation intensity in the plant's hot chamber. The construction of the plant, loading and unloading procedures for the cobalt sources, and radiation protection measures for the staff are also described. (auth)

21850

THE Co^{60} IRRADIATION FACILITY AND THE GAMMA FIELD AT RISÖ. A. Brynjolfsson and N. W. Holm (Danish Atomic Energy Commission, Risö). p.115-20 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The Co^{60} irradiation facility and its gamma field at the Agricultural Department of the Research Establishment, Risö are described. The facility contains 1,800 curies of Co^{60}. Details of the construction are given together with the safety precautions included in the design. Dosimetry

was carried out by four different methods. A general outline is given of the gamma field, including details of source position. The dose rate is approximately 100 r/hr at a distance of 1 m. An area of radius 15 m is used for the growing of plants under irradiation. A brief indication is given of the glass of products which have been irradiated in the two facilities. (auth)

21851

DESIGN EXPERIENCE ON A MULTI-MECACURIE RADIATION FACILITY. D. C. Brunton, J. Donovan (Curtiss-Wright Corp., Princeton, N. J.), and L. Voyvodic. p. 127-39 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Research and development work on radiator design and engineering were carried out on the design of the "High Intensity Food Irradiator." The problems discussed are those common to all large package irradiators. The first phase of the research and development work was devoted to achieving a clear understanding of plaque type radiators and the effect of changes in the design parameters on the performance of such a unit. The performance of a single plaque radiator was studied theoretically, experimentally, and by computer analysis. The parameters studied were source size and specific activity, source thickness and cladding, target density and geometrical factors including source and target heights, lengths and widths, and size of air gap between source and target. The performance was examined with respect to capacity, dwell time in the unit, dose uniformity, unit efficiency, and overall cost. Simplified expressions for radiator performance were developed and verified by experiment. A three-dimensional code for applying a Monte Carlo type analysis to radiator performance has been developed and applied to this problem with good agreement with experimental measurements. The radiator design programme was expanded to include an investigation of multi-plaque, multi-pass systems and hence includes essentially the three-dimensional matrix of sources as well as plaque type radiators. Engineering requirements with respect to conveyors for product handling are examined in conjunction with source design and effect on performance specifications. Source handling methods, safety systems, and facility controls are likewise reviewed. Finally the preparation of the source material itself including measurement, encapsulation, and leak testing is described. (auth)

21852

GAMMA RADIATION SOURCES OF THE TECHNOLOGICAL IRRADIATION GROUP, U.K.A.E.A. S. Jefferson, G. S. Murray, and F. Rogers. p.179-87 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The construction and operation of two large radiation units are described which are capable of handling quantities sufficient for pilot scale trials. The first unit described uses the spent fuel elements from the materials testing reactors DIDO and PLUTO. The second unit uses a Co^{60} gamma radiation source of approximately 150,000 curies providing doses in the range of 10,000 rads to 5 megarads. It is indicated that this unit will be able to give a 2.5-megarad dose to 200 cubic feet of processed material per day. (auth)

21853

CHEMICAL PRODUCTION USING FISSION FRAGMENTS. J. K. Dawson and F. Moseley (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.223-30 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Recent progress made on the use of fission recoil fragment energy for the production of chemicals of industrial importance at AERE, Harwell, are summarized. The range–energy relationship for fission fragments is discussed in the context of the choice of fuel system for a chemical production reactor, and the experimental observation of a variation of chemical effect along the length of a fission fragment track is described for the irradiation of nitrogen-oxygen mixtures. Recent results are given on the effect of fission fragments on carbon monoxide–hydrogen gas mixtures and on water vapour. No system investigated to date shows any outstanding promise for large-scale chemical production. (auth)

21854

PRESERVATION OF FOODSTUFFS WITH IONIZING RADIATION. Wladyslaw Bednarczyk (Committee of the Tech. and Chemistry of Food Products, Polish Academy of Sciences, Warsaw). p.403-65 of "Postepy Wdziedzinie Metodyki Utrwalania Zywnosci." Warsaw, Office of the Government Commissioner for use of Nuclear Energy, Palace of Culture and Science, 1959. 479p. (In Polish)

The application of ionizing radiation to the preservation of foodstuffs is discussed. The chemical effects of ionizing radiation on amino acids, albumen, enzymes, carbohydrates, and vitamins is discussed; indicating, for example, that vitamins in pure water solution are much more susceptible to radiation damage than vitamins in foods, and that vitamin loss by irradiation is no greater than that incurred by other means of preservation. A table is given of percentile damage produced by ordinary thermal sterilization and by a sterilizing dose of radiation. A discussion of biological effects indicates that doses lower than "sterilization" magnitude, 3 to 6 Mr for the hardiest bacteria, can arrest the growth of bacterial colonies, trichinosis, insects, mold, etc. "Pasteurization" doses are contrasted to "sterilization" doses. The latter can prolong the life of vegetables and meats by a factor of four, using existing storage methods, and do not have the undesirable side effects of the former. Dose measurement, sources, physical arrangements, and costs are discussed. Future costs are estimated at 2.34 cents per pound for sterilization and 0.0585 to 0.585 cents per pound for pasteurization (2 to 20 kr) using a cathode ray generator. Radioactive sources reduce the sterilization cost to 0.702 cents per pound. A historical and contemporary survey of facilities and future plans is given. (TTT)

21855

FOOD IRRADIATION IN THE UNITED STATES. R. G. H. Siu (U. S. Army Quartermaster Corps, Washington, D. C.). p.253-8 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Developments in the preservation of food by radiation are reviewed. (C.H.)

21856

TECHNICAL ASPECTS OF FOOD IRRADIATION. B. S. Schweigert (Univ. of Chicago). p.259-61 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

Applications of radiation in the preservation of foods are reviewed with emphasis on research involving bacteriology and chemistry. (C.H.)

ISOTOPE SEPARATION

21857 CEA-tr-X-197

REMARQUES SUR L'UTILISATION DE LA FLUIDISATION DANS LA RÉACTION D'ÉCHANGE ISOTOPIQUE PAR CONTACT: $HD + H_2O_{Vapeur} \rightleftharpoons H_2 + HDO_{Vapeur}$. (Remarks on the use of Fluidization in the Contact Isotope Exchange Reaction: $HD + H_2O_{Vapor} \rightleftharpoons H_2 + HDO_{Vapor}$.) A. Selecki. Translated into French from Nukleonika 3, 661-72(1958). 23p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 17903.

21858

ON THE ELECTROMAGNETIC ISOTOPE SEPARATION FROM NON-VOLATILE COMPOUNDS OF TELLURIUM, THALLIUM, LEAD AND BROMINE. Włodzimierz Żuk. Ann. Univ. Mariae Curie-Skłodowska, Lubin-Polonia, Sect. AA, 12, 1-14(1957). (In Polish)

Experimental results obtained from electromagnetic isotope separations of tellurium, thallium, lead, and bromine are given. Chemical compounds of the elements which were separated, and temperatures necessary to obtain ion currents are included. For each element and chemical compound the separation efficiency between 1.5% for Te and 30% for Tl was calculated. The theory of 90° magnetic lens is also given, and the construction of the magnetic ion source with an electric arc, as well as the separator chamber and electromagnet, is briefly described. (auth)

21859

THERMAL-DIFFUSION-COLUMN SHAPE FACTORS FOR THE LENNARD-JONES (12-6) POTENTIAL. B. B. McInteer and M. J. Reisfeld (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 33, 570-3(1960) Aug.

The theory of the hot-wire thermal-diffusion column as developed by Jones and Furry involves the shape factors h, k_c, and k_d, which are functions of the transport properties of the gas. The shape factors were evaluated numerically for a gas whose molecules interact according to the Lennard-Jones (12-6) potential, given by $V(r) = 4\epsilon[(\sigma/r)^{12} - (\sigma/r)^6]$. The results are tabulated for a range of kT/ϵ from 0.8 to 30 for temperature ratios as great as 6 and for ratios of column radii up to 100. These values are more accurate than those previously computed for potentials varying as r^{-5} (Maxwellian) and for $r^{-\infty}$ (rigid spheres). The values for the constants are found to give good agreement with experimental data on the system He^3-He^4. (auth)

21860

COMMENT ON THE HOMOGENEOUS EXCHANGE REACTION BETWEEN HYDROGEN AND DEUTERIUM. A. Cimino, E. Molinari, and G. G. Volpi (Università, Rome). J. Chem. Phys. 33, 616-17(1960) Aug.

Some comments are presented on the H_2-D_2 exchange reaction, particularly on the effects of O_2, heterogeneous production of HD, and kinetic calculations. It is shown that O_2 can exert a heterogeneous effect on the exchange at all temperatures because of the O_2 absorbed on the walls of the reaction vessel; however, it has no effect on the activation energy. In order to eliminate this effect completely, it is necessary to outgas the vessel at ~1100°C with a vacuum jacket around it. As for the heterogeneous production of HD, the portion of the authors' previous work (800 to 1010°K) made from 910 to 1010°K is free from this effect and hence can be examined for the homogeneous reaction. A trivial error in the authors' figures is clarified. In the calculation of the reaction kinetics, it is pointed out that some assumption must be made regarding the ratio [H]/[D]. (D.L.C.)

21861

DEMONSTRATION OF AN ISOTOPE CONTAMINATION PROCESS IN ELECTRO-MAGNETIC ISOTOPE SEPARATORS. R. Bernas (Faculté des Sciences, Orsay, France) and C. Cassignol (Commissariat à l'Énergie Atomique, Saclay, France). J. phys. radium 21, 566-8(1960) June. (In French)

A process is described by which contamination of an isotope by an isotope of immediately higher mass occurs in electromagnetic separation. In an experiment with Cd using a two-stage apparatus with the slit image of the first stage being the object of the second, an increase of pressure to about 5×10^{-5} mm Hg in the first stage causes attenuation of the 114 and 113 peaks and the appearance of 114 and 112 peaks. It is attributed to a diffusion phenomenon without charge changing in the first stage. (T.R.H.)

21862

Argentina. Comision Nacional de Energia Atomica, Buenos Aires.

MÉTODO GRÁFICO PARA DETERMINAR LA DISTRIBUCIÓN DE CONCENTRACIONES EN COLUMNAS DE DIFUSIÓN TÉRMICA. Informe No. 16. (Graphic Method for the Determination of Concentration Distributions in Thermal Diffusion Columns. Report No. 16). Enrique Silberman and Carlos R. Carjuzat. 1959. 7p.

The introduction of a longitudinal reduction method that permits a graphical calculation of the concentration distribution in equilibrium in thermal diffusion columns is reported. The method is particularly useful in obtaining rapid information of approximate incidence of column longitude and initial concentration distribution. (tr-auth)

21863

"ION SOURCES". (to United Kingdom Atomic Energy Authority). British Patent 841,821. July 20, 1960.

An apparatus is described for producing ions of uranium and uranium halides for use in separating isotopes of these metals. (W.L.H.)

21864

APPARATUS FOR THE SEPARATION OF FLUIDS HAVING DIFFERENT DENSITIES. (to Société Nationale d'Etude et de Construction de Moteurs d'Aviation). French Patent 1,185,884. Feb. 16, 1959.

A pressurized mixture of fluids having different densities, e.g., an isotopic mixture, is tangentially fed into the interior of a stationary body of revolution, where it acquires such a gyratory movement as to create a whirlpool. Centrifugal effects cause an enrichment of the light and heavy fractions of the feed in the axial and peripheral region, respectively, of the whirlpool; outlets are placed accordingly. Various embodiments of the invention are given comprising means for (a) improvement of the efficiency of the apparatus by transforming the kinetic energy of the outlet stream into pressure, (b) elimination of shock waves, (c) regulation of the outlet cross sections, and (d) pressure regulation in order to correlate the mean free path of the fluid molecules with the outlet cross sections.

21865

METHOD AND APPARATUS FOR LITHIUM ISOTOPE SEPARATION BY ELECTROLYSIS OF FUSED SALTS. (to

Commissariat à l'Énergie Atomique). French Patent 1,190,099. Mar. 31, 1959.

An electromigration separation method is described, based on well known principles, in which the liquid counter current is established by continuously or discontinuously adding to the cathode compartment a thermally decomposable salt, capable of combining with the deposited metallic Li (e.g., NH_4NO_3). The excess salt is thermally decomposed in an intermediate compartment between the anode and cathode compartments. Because of its lower melting point $LiNO_3$ is preferred to the usual LiCl as starting material.

21866

IMPROVEMENT IN THE LITHIUM ISOTOPE SEPARATION PROCESS. (to Commissariat à l'Énergie Atomique). French Patent 1,195,421. May 19, 1959.

Multi-stage isotope separation is effected by countercurrently contacting a solution of a Li salt in an organic solvent (e.g., LiBr or LiCl in dimethylformamide, or LiBr in tetrahydrofuran) and finely divided Li amalgam; by exchange the solution is enriched in Li^7 and the amalgam in Li^6. The amalgam extracted from the bottom of an exchange column is treated with a solution of the relevant hydrogen halide; after evaporation the dry lithium salt is dissolved in the organic solvent, and this solution is partly returned as the reflux to the bottom of the same column and partly fed to the next column. The solution extracted from the top of a column is partly evaporated, the dry lithium salt dissolved in water, and this solution electrolyzed with a Hg cathode; the Li amalgam thus formed is returned as the reflux to the top of the same column. The other part of the top solution is fed to the previous column.

21867

IMPROVEMENTS IN PROCESSES AND APPARATUS FOR SEPARATING ELECTRICALLY CHARGED PARTICLES. (to Oesterreichische Studiengesellschaft für Atomenergie GmbH). French Patent 1,196,670. May 25, 1959.

A mass spectroscopic isotope separation method and apparatus in which the magnetic field is eliminated are described. The charged particles are caused to traverse alternately a high-frequency alternating electric field and a homogeneous or inhomogeneous electrostatic field. A schematic arrangement, consisting of flat or curved capacitors and interposed perforated modulators, is given as well as an exposition of the underlying theory. The method is said to enable the exact determination of nuclear masses and of isotope abundances.

21868

MANUFACTURE OF A POROUS BODY FOR ISOTOPE SEPARATION. (to N.V. Philips' Gloeilampenfabrieken). French Patent 1,198,235. June 8, 1959.

A chemically resistant diffusion barrier for the separation of $U^{235}F_6$ and $U^{235}F_6$ is made by first forming a gel of CaF_2 and an aqueous solution of a decomposable but unattackable gelatinizing agent ($Ca(MnO_4)_2$, $Cu(NO_3)_2$, $UO_2(NO_3)_2$, or NH_4NO_3), mixing this gel with more CaF_2, molding or extruding the plastic composition, and finally heating at 100 to 1200°C. Pore dimensions are influenced by (a) the particle size of the CaF_2, (b) the gel/CaF_2 ratio, (c) time and temperature of heating, and (d) leaching of the final product.

21869

METHOD OF CENTRIFUGE OPERATION. K. Cohen (to U. S. Atomic Energy Commission). U. S. Patent 2,936,110. May 10, 1960.

A method of isotope separation is described in which two streams are flowed axially of, and countercurrently through, a cylindrical centrifuge bowl. Under the influence of a centrifugal field, the light fraction is concentrated in a stream flowing through the central portion of the bowl, whereas the heavy fraction is concentrated in a stream at the periphery thereof.

MATHEMATICS AND COMPUTERS

21870 KAPL-M-GLB-2

Knolls Atomic Power Lab., Schenectady, N. Y.

A PROBABILITY DISTRIBUTION FOR RANDOM GROUPING OF ITEMS FROM A LOT AND ITS USE IN PROVIDING ASSURANCE ON THE PERCENT OF DEFECTIVE GROUPS. M. Halperin and G. L. Burrows. June 29, 1960. 18p. Contract W-31-109-Eng-52. OTS.

Sampling is often carried out in order to estimate or put confidence limits on a probability. On a manufactured product probability is often simply the percent of defective items produced, if defective items occur randomly. The exact and asymptotic distributions are given of m(x), the number of sublots, each of size s, containing x or more defectives from among ks items containing D defectives. (W.D.M.)

21871 KAPL-M-JA-9

Knolls Atomic Power Lab., Schenectady, N. Y.

UTILIZATION OF TAPES IN THE KARE SYSTEM. J. A. Archibald, Jr., R. D. Burgess, M. A. Ketchum, A. W. Thomas, and D. E. Thomas. June 1960. 16p. Contract W-31-109-Eng-52. OTS.

Utilization of tapes in the KARE system is described. The KARE system was designed to run with the BKS operator system. The program tape is read and the output tape written by the BKS system. The input tape is read by the CONVIX routine. All other reading and writing is done by XACT. (M.C.G.)

21872 NAA-SR-Memo-5130

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

ORIGIN AND REMOVAL OF ASYMMETRIES IN S_N APPROXIMATIONS TO THE BOLTZMANN EQUATION. R. A. Axford. Mar. 30, 1960. 11p. OTS.

The reactor fluxes for a non-absorbing slab with a uniform unit source of neutrons across the entire slab were studied using S_N approximations to the Boltzmann equation. It is shown why the original S_N prescriptions do not give the expected flux symmetries. The study is restricted to the case of N = 2. (C.J.G.)

21873 NP-8902

Illinois. Univ., Urbana.

A DIRECT METHOD FOR THE EVALUATION OF THE LINE SHAPE FUNCTIONS

$$\Psi(x,t) = \frac{1}{2\sqrt{\pi t}} \int_{-\infty}^{\infty} \frac{dy}{1+y^2} e^{-\frac{(x-y)^2}{4t}}$$

$$X(x,t) = \frac{1}{2\sqrt{\pi t}} \int_{-\infty}^{\infty} \frac{y\,dy}{1+y^2} e^{-\frac{(x-y)^2}{4t}}$$

F. T. Adler and Y. D. Naliboff. June 1960. 7p.

The determination of the line shape functions Ψ and χ describing the Doppler broadening of neutron cross sections often requires lengthy numerical calculations. A direct method for calculating Ψ and χ is presented which is significantly faster for computer applications than procedures currently in use. (auth)

21874 UCRL-9263
California. Univ., Berkeley. Lawrence Radiation Lab.
A GENERAL LEAST-SQUARES PROGRAM FOR THE IBM 650 COMPUTER. Lester K. Goodwin. June 14, 1960. 22p. Contract W-7405-eng-48. OTS.

An IBM 650 computer program is described which makes a least-squares fit to any number of data points (x,y) exact in x and uncertain in y to a function of the form $y(x) = \sum_{k=0}^{n} a_k \phi_k(x)$, where $\phi_k(x)$ is an arbitrary function of x only, and $0 \leq n \leq 10$. The program can be used to compute the fitted parameters, a_k, and makes tables of y(x) for a range of values of x. It gives the error matrix for the fit, and uses it to propagate errors in the calculated quantities. It can also be used to calculate the quantities necessary to make a statistical test of the goodness of fit of the function to the points. (auth)

21875 WAPD-TM-224
Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.
54 GROUP LIBRARY FOR P-1 PROGRAMS. A. F. Henry. April 1960. 121p. Contract AT-11-1-GEN-14. OTS.

A summary is presented of the 54 group nuclear parameters available as of April 1960 on the library tape for computer programs P1MG and MUFT, the first being a multigroup, space-energy, P-1 approximation to the transport equation and the second being a space-independent solution for the same problem. Definitions of the tabulated quantities and some indication of the authors and sources of nuclear data, used to obtain the quantities, are provided. (auth)

21876
CONSTRUCTION OF GALOIS FIELDS OF CHARACTERISTIC TWO AND IRREDUCIBLE POLYNOMIALS. J. D. Swift (Univ. of California, Los Angeles). Math. Computation 14, 99-103(1960) Apr.

A practical method of constructing Galois fields of characteristic two and simultaneously giving a way of generating a large supply of irreducible polynomials was developed. The only problems left by the Galois field structure theorems are those of finding an irreducible polynomial of degree m over the base field and of finding a primitive generator of the field with respect to the polynomial. The primary tool in the investigation was a high-speed routine programmed for SWAC. It was used to find possible generators which were in turn used to produce irreducible polynomials. (M.C.G.)

21877
TWO-PERIOD GREEN'S FUNCTION IN STATISTICAL PHYSICS. D. N. Zubarev. Uspekhi Fiz. Nauk 71, 71-116 (1960) May. (In Russian)

Various aspects of the application of Green's functions in statistical physics are reviewed, and the future applications of two-period functions (retarding and advancing) are analyzed. The principle properties of the two-period Green's function and their simplest application in irreversible process theory, in the theory of superconductors, in ferromagnetics, and in electron-lattice reactions in common metals and semiconductors are discussed. It is also shown that the causal Green's functions can be successfully replaced with retarding and advancing Green's functions in the analytical expansion of the complex plane. Statistical mechanics sometimes employs the Motsubara temperature Green's functions which are not related to time; however, they are less adaptable than the temperature-time Green's functions. (R.V.J.)

21878
SIMULTANEOUS DIFFERENTIAL EQUATION COMPUTER. D. M. Collier, L. A. Meeks, and J. P. Palmer (to U. S. Atomic Energy Commission). U. S. Patent 2,936,119. May 10, 1960.

A description is given for an electronic simulator for a system of simultaneous differential equations, including nonlinear equations. As a specific example, a homogeneous nuclear reactor system including a reactor fluid, heat exchanger, and a steam boiler may be simulated, with the nonlinearity resulting from a consideration of temperature effects taken into account. The simulator includes three operational amplifiers, a multiplier, appropriate potential sources, and interconnecting R–C networks.

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

21879 BMI-1152
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING DECEMBER 1956. Russell W. Dayton and Clyde R. Tipton, Jr. Jan. 1, 1957. Decl. Mar. 30, 1960. 83p. Contract W-7405-eng-92. OTS.

Research is reported in the development of materials for Hanford reactors, development of Al-clad fuel elements, plant assistance to MCW, reactions between water and Zr alloys, general fuel element development, Zr–U alloy studies, corrosion of Zr, reactor materials development, physical metallurgy, development of PWR, and Na-Ta compatibility at high temperatures. (For preceding period see BMI-1136.) (T.R.H.)

21880 BMI-1161; BMI-1173; BMI-1176
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JANUARY, FEBRUARY, MARCH 1957. Russell W. Dayton and Clyde R. Tipton, Jr. (Jan. (BMI-1161). Feb. 1. 76p.; Feb. (BMI-1173). Mar. 1. 72p.; Mar. (BMI-1176). Apr. 1. 80p.). Decl. Mar. 30, 1960. Contract W-7405-eng-92. OTS.

These three reports were issued separately, but are cataloged as a unit.

Progress is reported in the development of U and Zr alloys for Hanford Reactors, extrusion of Al-clad fuel plates, properties of UO_2, corrosion of stainless steels, salt baths for U heat treatment, galling in Mg–UF_4 compacting, development of U alloys for fuels, corrosion of U, development and testing of U–Zr alloys, corrosion of Zr and Zr alloys, constitution of ternary U alloys, corrosion problems in Zircex Process and Darex Process, and evaluation of a reflector-controlled heterogeneous boiling reactor. (For preceding period see BMI-1152.) (T.R.H.)

21881 BMI-1201
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JUNE 1957. Russell W. Dayton and Clyde R. Tipton, Jr. July 1, 1957. Decl. Mar. 30, 1960. 52p. Contract W-7405-eng-92. OTS.

Progress is reported on the following studies: development of materials for Hanford reactors, developments for Al-clad fuel elements, studies of Zr–U alloys, corrosion studies of Zr, reactor-materials development, physical metallurgy, corrosion problems associated with the recovery of spent reactor fuel elements, evaluation of a reflector-controlled heterogeneous boiling reactor, studies of Na–Ta compatibility at elevated temperatures, and de-

velopment studies for the PWR. (For preceding period see BMI-1189.) (W.L.H.)

21882 BMI-1213

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JULY 1957. Russell W. Dayton and Clyde R. Tipton, Jr. Aug. 1, 1957. Decl. Mar. 30, 1960. 56p. Contract W-7405-eng-92. OTS.

Investigations are reported in: creep properties of annealed Zircaloy-2 and -3 at high temperatures; burst strength of welded Zircaloy-2 tubes; air oxidation of Nb, Nb–V, Nb–Mo, and Nb–Zr at 1000°C; vapor deposition of Mo coatings on stainless steel tubing; bonding fundamentals; niobium–hydrogen reactions; creep and stress-rupture of sintered Ta at 1200°F in He; and determination of O in liquid Na by gettering. (For preceding period see BMI-1201.) (T.R.H.)

21883 BMI-1448(Rev.)

Battelle Memorial Inst., Columbus, Ohio.

PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING JUNE 1960. Russell W. Dayton and Clyde R. Tipton, Jr. July 1, 1960. 104p. OTS.

Solid solutions of uranium oxide containing massive additions of La_2O_3 or Y_2O_3 are being investigated with respect to their stability in an oxidizing environment at higher temperatures. An investigation is being conducted on the effects of ultrahigh pressure and high temperature on the U–O system and on reactions of uranium oxides with various mixed oxides. Work was continued on the investigation of the effects of fast-neutron irradiation upon the mechanical properties of Type 347 stainless steel. Experimental work was completed in the program to develop a corrosion resistant, high-strength, low-cross-section Nb alloy for pressurized water-reactor applications. The creep behavior or Zircaloy-2 during irradiation is to be studied by comparing the total creep deformation obtained under reactor conditions and that obtained out of reactor. Friction and wear studies in vacuum, in argon, and in sodium environments were continued for W on W specimens and for Mo on stainless steel coated Na_2MoO_4. Corrosion tests of the Nb–U alloys were continued in 600°F water with an accumulation of 336 days of exposure. Thorium–uranium and Th–U–base alloys are being investigated with the aim of improving their irradiation stability. Studies of diffusion of fission gases and of iodine in single crystals or fused UO_2 plates have continued. Methods of fabricating 60 to 90 vol.% UO_2 cermets to 90% of theoretical density or greater were investigated. Economical methods for producing useful UC components from powders are being studied. Further progress in research directed toward preparation of high-purity and high-quality single crystals of UO_2 was made. The program concerned with obtaining electrical- and thermal-conductivity measurements for UO_2 before and after irradiation was resumed. A study of the corrosion properties of welding alloys for use with Hastelloy F was completed. Data are reported on the stress-rupture strength of Al–35 wt.% U alloys. The corrosion of Ta and Ta alloys by liquid Pu alloys is being studied. Research on core materials for both the MGCR and HTGR is in progress. For the MGCR, the major effort is on development and evaluation of UO_2 dispersions in BeO and Al_2O_3 and dispersions of UC or UC_2 in graphite. For the HTGR, vapor deposition is being investigated as a method of preparing and coating UC and ThC powder. Techniques are being developed for the preparation of instrumented SM-1. Type fuel plates for in-pile test evaluation. Materials were selected, fabrication techniques developed, and specifications written for the production of SM-2 fuel plates. A study is being made of the processing variables in the fabrication of BeO–UO_2 ceramics. The study of the radiation stability of various potential ML-1 fuel material is progressing. The corrosion of Th and U under storage conditions is being investigated. An investigation of the behavior of Pu in a pyrometallurgical process developed for the recovery of U from spent fuel elements was completed. (For preceding period see BMI-1442.) (W.L.H.)

21884 BMI-1453

Battelle Memorial Inst., Columbus, Ohio.

APPARATUS FOR THE STUDY OF FISSION-GAS RELEASE FROM FUELS DURING POSTIRRADIATION HEATING AT TEMPERATURES UP TO 1600 C. Russell H. Barnes and Duane N. Sunderman. July 22, 1960. 15p. Contract W-7405-eng-92. OTS.

An apparatus to study rare-gas fission-product release from nuclear fuel materials during postirradiation heating was developed. Xenon and krypton fission gases escaping from a small specimen during heating at constant temperature are measured using a continuous radioactivity monitor and charcoal adsorption traps. The rhodium-wound furnace is capable of operation at 1600°C. Helium carrier gas is purified by activated alumina, copper, and zirconium traps, and the oxygen and moisture contents of the gas are monitored continuously. The operating procedure and data are presented for a typical heating experiment in which fused uranium dioxide was studied. (auth)

21885 KAPL-1447

Knolls Atomic Power Lab., Schenectady, N. Y.

BURNABLE POISON ADDITIVES TO URANIUM DIOXIDE. G. L. Ploetz and H. G. Sowman. Nov. 17, 1955. Decl. Mar. 16, 1960. 12p. Contract W-31-109-eng-52. OTS.

A preliminary investigation of the possibility of incorporating a nuclear poison in uranium dioxide was made. Compounds of cadmium, boron, and hafnium were used in this work. It was found that of the ten cadmium compounds added to UO_2 cadmium titanate was the most promising from the standpoint of density, sinterability, and retention. Titanium borate glass retained half of the boron originally added to UO_2 after sintering. Hafnium oxide was found to give good results with no loss of hafnium encountered during sintering. (auth)

21886 KAPL-2000-9

Knolls Atomic Power Lab., Schenectady, N. Y.

REACTOR TECHNOLOGY REPORT NO. 12—METALLURGY. Mar. 1960. 99p. Contract W-31-109-Eng-52. OTS.

Eleven papers are presented on welding, structural materials, and fuel and control materials. Separate abstracts were prepared for 7 papers, the other four having previously appeared in NSA. (For preceding period see KAPL-2000-5.) (W.L.H.)

21887 KAPL-2000-9(p.B.24-B.34)

Knolls Atomic Power Lab., Schenectady, N. Y.

APPLICATION OF INCONEL TO COMPONENTS OF PRESSURIZED, HIGH-TEMPERATURE WATER NUCLEAR REACTOR SYSTEMS. W. L. Fleischmann and J. L. VanUllen. 11p.

Investigations of mechanical strength, wear, and irradiation are summarized for Inconel. Shop experience in the manufacture of nuclear plant components from Inconel is reported. (W.L.H.)

21888 KY-348

Union Carbide Nuclear Co. Paducah Plant, Ky.

PRODUCTION OF MOLYBDENUM–URANIUM AND ZIRCONIUM–URANIUM ALLOYS. C. W. Loveland and J. E.

Owen. Aug. 10, 1960. 25p. Contract W-7405-eng-26. OTS.

Molybdenum–uranium metal alloys containing 3, 6, 10, and 14 wt. % molybdenum and a zirconium–uranium alloy containing 2 wt. % zirconium were successfully produced in the Paducah Metals Plant using the coreduction method. Various ratios of molybdenum metal powder and molybdenum trioxide were blended with depleted uranium tetrafluoride (UF_4) and magnesium metal and charged into refractory-lined (MgF_2) steel bomb shells for reduction. Likewise, the zirconium–uranium alloy derbies were produced by the coreduction of UF_4, reactor grade zirconium tetrafluoride (ZrF_4) and magnesium metal. The resultant alloy derbies were roasted at 1200°F for approximately two hours, followed by a water quench, to remove surface impurities. Afterwards, the derbies were melted under vacuum in an induction furnace and cast into 3-inch diameter ingots. (auth)

21889 MND-P-2349

Martin Co. Nuclear Div., Baltimore.

SNAP-1A FUEL CORE MATERIALS DEVELOPMENT SUMMARY. [Period covered]: July 1959 through June 1960. 87p. Contract AT(30-3)-217. OTS.

Several materials were evaluated for use as the fuel container material for the SNAP 125-w thermoelectric generator. The materials were subjected to air oxidation, mercury and sea water corrosion, liquid O_2 resistance, and fuel compatibility tests. Of the materials tested, Inconel X and Allegheny Ludlum S-816 exhibited the better qualities. For fuel materials, CeO_2, Ce_2O_3, CeF_3, and mixtures of these materials were evaluated relative to fabrication, burnup and high-temperature properties. The fuel material selected consists of $Ce^{144}O_2$ (+10% by weight of SiC) or $Ce^{144}F_3$. At a heating rate of 180 Btu/ft^2-sec, a 1-in.-diam pellet of CeO_2 + 10% SiC would burn up in 30 sec; a similar pellet of CeF_3 would burn up in 65 sec. Plasma flame tests showed that the fuel container materials considered (Inconel X, Allegheny Ludlum S-816, and Type 316 stainless steel) would melt and ablate during reentry from orbit. At a heating rate of 100 Btu/ft^2-sec, material recession rates were determined to be 2, 2.5, and 5.5 mils/sec for Inconel-X, Allegheny Ludlum S-816, and Type 316 stainless steel, respectively. (C.J.G.)

21890 NASA-TN-D-300

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

TEMPERATURE HISTORIES IN CERAMIC-INSULATED HEAT-SINK NOZZLE. Carl C. Ciepluch. July 1960. 26p.

Temperature histories were calculated for a composite nozzle wall by a simplified numerical integration calculation procedure. These calculations indicated that there is a unique ratio of insulation and metal heat-sink thickness that will minimize total wall thickness for a given operating condition and required running time. The optimum insulation and metal thickness varies throughout the nozzle as a result of the variation in heat-transfer rate. The use of low chamber pressure was found to result in a significant increase in the maximum running time of a given weight nozzle. Experimentally measured wall temperatures were lower than those calculated. This was due in part to the assumption of one-dimensional or slab heat flow in the calculation procedure. (auth)

21891 NP-8913

National Research Corp., Cambridge, Mass.

DEVELOPMENT OF TANTALUM–TUNGSTEN ALLOYS FOR HIGH PERFORMANCE PROPULSION SYSTEM COMPONENTS. Ta-W Quarterly Report No. 4 [Covering] Period January 10 to April 9, 1960. M. L. Torti. 52p. NRC Project No. 11-1-032. Contract NOrd-18787.

The successful firing of a thin-walled tantalum–20% tungsten nozzle is reported. Nozzle insert blanks containing from 15 to 30% tungsten were cast and are awaiting testing. Jetavator bar test firings show no variation in erosion with grain size or cold work for tantalum–10% tungsten. Extrusion investigations are underway for the tantalum–10 to 20% tungsten alloys, and billets were prepared. The tensile strength and bend ductility of welds in tantalum–10% tungsten sheet are reported. The effect of carbon upon the microstructure of tantalum–10% tungsten was investigated. Nozzle inserts have been carburized and are awaiting testing. (auth)

21892 TID-3204

Technical Information Service Extension, AEC.

ZIRCONIUM. A BIBLIOGRAPHY OF CONFIDENTIAL U. S. ATOMIC ENERGY COMMISSION REPORTS AVAILABLE THROUGH THE CIVILIAN APPLICATION PROGRAM. July 1956. Decl. Mar. 31, 1960. 60p. OTS.

A bibliography containing 339 annotated references to reports on zirconium is presented. Information is given on the chemistry; physical and nuclear properties; alloys; metal preparation and fabrication; and separation from fission products, hafnium, and other materials. References included are to reports written prior to September 1955. Author, subject, and report number indexes are provided. (auth)

21893 WADC-TR-59-303

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

METHODS OF PURIFICATION OF METALS AND INTERMETALLIC COMPOUNDS. Period covered: June 15, 1958 to May 14, 1959. Sherman Susman. June 1959. 85p. Project No. 7371. Contract AF33(616)-5895. (AD-231363).

The mechanisms of impurity transport through a solid in a temperature gradient are listed and discussed. The heat of transport, electric field effects, distillation phenomena, and grain boundary effects must be considered. Usually, the drive toward uniform fugacity or chemical potential is the dominant force acting on impurities. The physical and chemical properties of the silicon carbide, thorium oxide, and zirconium oxide systems are considered in the context of diffusion phenomena and thermoelectric behavior at elevated temperatures. Resistivity values of both pure and ceria-doped thoria are measured over a range of temperatures from 700 to 1000°C. Values of the activation energy are computed and compared with the literature. Doping with ceria appears to yield minimal changes in the electrical properties of a thoria matrix. Calcia stabilized zirconia matrix gives a simple band structure while ceria stabilized material is more complex. Zirconia samples evidence considerably lower resistances than comparable thoria specimens. Apparatus is described for the measurement of thermal conductivity by a relatively simple technique. The sources of error associated with the high temperature measurement of thermal conductivity by more common methods are eliminated. Experimentally, inductive coupling and spectrometric diffusibility are used to investigate transport phenomena. Impurity distribution in polycrystalline silicon carbide is followed by spectrographic analysis. The data are analyzed in terms of an empirical working parameter, p, which describes the sum total of all purification effects in the thermal gradient for selected impurities. Purification trends appear for calium and aluminum. For polycrystalline silicon carbide $p_{Ca} = 32.8$ and $p_{Al} = 8.4$. The spectrometric diffusibility technique is used to investigate single

crystal silicon carbide. This method affords the possibility of establishing in a rapid fashion an index of the ease with which a given impurity can be transported through a solid matrix. The results obtained are discussed in terms of the time dependence of the concentration gradients and temperature gradients generated by the anode spot. The $J_t S_t / C_{oi}$ ratios for copper, calcium, and aluminum are found to be 113, 194, and 58, respectively. (auth)

21894 WADC-TR-59-314

National Bureau of Standards, Washington, D. C. PREPARATION OF HIGH PURITY W, Mo, Ta, Nb, AND Zr. [Period covered]: February 1958 to February 1959. George A. Moore and L. L. Wyman. July 1959. 13p. Project 7360. Contract AF33(616)-58-11. (AD-232137). OTS.

In studies on the preparation of high-purity refractory metals, halide decomposition and zone melting apparatus was assembled. Test and calibration of the apparatus are discussed. The metals are to be prepared in the following manner: (1) ion exchange purification; (2) volatile halide preparation and subsequent purification by fractional distillation; (3) halide reduction on hot wire; and (4) zone melting and zone refining of the rods. (C.J.G.)

21895 ZFK-WF-1

Germany. Zentralinstitut für Kernphysik, Dresden. URAN–SILIZIUM–LEGIERUNGEN UND–VERBINDUNGEN. (Uranium–Silicon Alloys and Compounds). H. Steinkopff and F. Thümmler. Sept. 1959. 28p.

After introductory notes concerning the interest of nuclear engineering in the development of applicable uranium fuel systems, the U–Si equilibrium diagram is presented. Preparation and properties of the intermetallic compounds occurring are discussed following some observations on U–Si alloys with low Si content. Particularly described is U_3Si known for its high U content and its remarkably good corrosion resistance in water at high temperatures. In addition, a description is given of the behavior of U_3Si subjected to irradiation and of studies with simulated fuel elements. The only partially published results from irradiation tests at higher temperatures (up to 700°C) and higher burnups (0,8 at.%) led to the preliminary conclusion that U_3Si cannot be considered as a proper high-temperature fuel. For the final evaluation of the results a greater number of investigations is necessary especially under reactor conditions and with a U_3Si obtaining all optimum properties simultaneously. Possibilities of further development were pointed out. Insufficient information about the higher silicides prevent suggesting possible applications. (auth)

21896 JPRS-3212

POWDERED-METAL TITANIUM BASE ALLOYS. N. N. Timoshenko, B. A. Borok, E. (Ye.) V. Petunina, R. P. Shchegoleva, and L. S. Golubeva. Translated from Tsvetnye Metally 33, 68-74(1960). 12p. OTS.

Techniques of producing Ti alloys by powder metallurgy methods are discussed. The properties of various Ti alloys are discussed relative to various applications. (C.J.G.)

21897 SCL-T-318

FOAM (SPONGE) PLASTICS. CONCEPTS AND CLASSIFICATION. GERMAN INDUSTRIAL STANDARDS: DIN 7726. (Schaumstoffe, Begriffe Einteilung. (Deutsche Industrie-Norm). DIN 7726). Translated by Marcel I. Weinreich (Sandia Corp.). 4p. JCL.

A method of classifying foam plastics (synthetically produced materials of a low specific gravity and possessing a cellular structure) is given. (C.J.G.)

21898 TT-889

ASSAYING OF ORES AND PRODUCTS OF NON-FERROUS METALLURGY WITH THE USE OF COPPER FUSION. (Probirnyi analiz rud i produktov tsvetnoi metallurgii s primeneniem mednoi plavki). E. A. Galankina and V. I. Bugrova. Translated by G. Belkov (National Research Council of Canada) from Analiz Rud Tsvetnykh Metal. i Produktov ikh Pererabotki, Sbornik Nauch. Trudov No. 12, 45-51(1956). 13p. NRC or JCL.

A method of assaying by use of copper as a collector in analyzing the complete products of non-ferrous metallurgical establishments is described. Copper oxide is introduced into the fusion charge along with a suitable flux. The resultant copper alloy is dissolved in nitric acid and filtered. The residue is dried on the filter, wrapped in lead foil, and cupeled. (J.R.D.)

21899

NEW DEVELOPMENT TENDENCIES IN THE RANGE OF REACTOR FUEL ELEMENTS. II. O. Werner (Bundesanstalt für Materialprüfung, Berlin). Kerntechnik 2, 234-8(1960) July-Aug. (In German)

The properties of ceramic fuel elements, uranium dioxides and carbides, and of cladding materials proposed and used for these fuel elements are described. In ceramic fuel elements compounded with a suitable canning material, a possible burn-up up to 10,000 Mwd/t is expected, whereas in the metallic fuel elements the most favorable burn-up to be expected is 300 Mwd/t. Difficulties, such as the heat conductivity of the ceramic fuel elements, must be overcome by suitable distribution or molding of the elements and by combination with metallic materials. (tr-auth)

21900

FUEL AND BREEDER ELEMENTS FOR NUCLEAR REACTORS. Werner Gutmann. Kerntechnik 2, 251-2(1960) July-Aug. (In German)

Considerations on the construction of reactor fuel elements in order to ensure optimum operating safety are described. It was proposed to arrange fuel elements of uranium monocarbide, plutonium monocarbide, or thorium monocarbide molded forms in a casing with a protective coating of carbides or silicides of elements of the IV and V group of the periodic system. (tr-auth)

21901

PRODUCTION OF THE POWDERS OF SOME OF THE REACTIVE METALS. G. L. Miller (Murex, Ltd., Rainham, Essex, Eng.). Powder Met. No. 1-2, 53-64(1958).

Methods of producing the powders of beryllium, zirconium, titanium, tantalum, and niobium are outlined. The purity level, particle size, storage, and appropriate comments are given corresponding to each production method. The most common impurities are oxygen, nitrogen, hydrogen, and carbon, and their importance depends on the purpose for which the powder is to be used. (B.O.G.)

21902

RECENT DEVELOPMENTS IN THE FIELD OF SILICIDES AND BORIDES OF THE HIGH-MELTING-POINT TRANSITION METALS. R. Kieffer and F. Benesovsky (Metallwerk Plansee A. G., Reutte, Tirol, Austria). Powder Met. No. 1-2, 145-71(1958).

The binary systems of silicides of the high-melting transition metals are now well understood, except for the hafnium–silicon system. Research since 1954 is reviewed, with particular reference to the compound Me_5Si_3 and its position in the silicide systems. Reference is made to the pseudo-binary and pseudo-ternary silicide systems. The structures of many of the intermetallic phases in the

binary boride systems were determined, but complete equilibrium diagrams still remain to be established in some cases. New tentative diagrams are given for the systems vanadium–boron, niobium–boron, and tantalum–boron, and structures are suggested for the borides V_3B_2, Nb_3B_2, and Ta_3B_2 with the T2 structure (isostructural with U_3Si_2). Ternary alloys of the systems Me–Si–B are of great interest, not only structurally but for practical reasons. The complete systems Me–Si–B of Group VI (Mo–Si–B and W–Si–B) were studied by x-ray, thermal-analysis, and micrographic methods. The system Cr–Si–B was determined and attention is directed to the possible commercial applications of certain alloys containing additions of metals of the iron group, in particular nickel, for sprayed coatings resistant to liquid aluminum. The question of cementing silicides and borides with metals and alloys is discussed theoretically. The character of the silicide or boride system in question and the behavior of the intermediate phase in relation to the bonding material are of decisive importance for the selection of the latter. Only very limited data are to be found in the literature on the behavior of silicides and borides in relation to metals and alloys. Alloys based on TiB_2, ZrB_2, $MoSi_2$, and WSi_2, impregnated with numerous metals and alloys, were prepared. Their structures were studied and the technical suitability of various combinations is discussed on the basis of their technological properties. (auth)

21903

METAL–CERAMIC MIXTURES. P. Murray (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Powder Met. No. 5, 64-80(1960).

The present position regarding cermets based on either oxides or carbides as the brittle phase is reviewed. The outlook for oxide systems is to some extent disappointing, since little gain in strength is found compared with the oxide itself. Oxide cermets do show an intermediate improvement in thermal shock-resistance that is useful in a number of directions. Carbide cermets appear adequate for many high-duty applications so far as thermal shock-resistance is concerned, but improvements in their resistance to mechanical shock are still necessary. Recent work on ductile ceramics is reviewed, and the importance of carrying out experiments at high strain rates is emphasized. Suggestions are made for further work in the field of cermets. (auth)

21904

THE OUTGASSING OF STEEL BY VACUUM IRRADIATION. NEW RESULTS AND DEVELOPMENTS. A. Tix and W. Coupette (Bochumer Verein, Bochum, Ger.). p.562-7 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In German)

In the treatment of steel in large-scale plants by the vacuum-irradiation outgassing process, as developed by the Bochumer Berein, a very fast outgassing process has appeared. This results from division of the steel into droplets of a certain size. Even at pressures of 1 mm Hg and lower, the H_2 value for outgassed steel follows the relation established by A. Sieverts. During the outgassing treatment it is possible to allow deoxidation agents or alloys to be present or slag reactions to take place. The large surface of the steel resulting from the droplet distribution allows very fast and complete treatment. It is further suggested that the steel is outgassed not in one but on two or more steps. Thus it is possible with the same pumping power to reach substantially lower pressures and to influence the metallurgical processes more strongly. The increase in heat and the slag reactions in the higher pressure stages are discussed. The step-wise outgassing in steel processing permits outgassing and casting in smaller ingots under vacuum. (tr-auth)

21905

REACTION COURSE IN VACUUM OUTGASSING OF MOLTEN STEEL. O. Winkler and Th. Kraus. (Gerätebau-Anstalt, Balzers, Liechtenstein). p.568-70 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In German)

In vacuum outgassing of steel the removal of H_2 to lessen flaking susceptibility and O_2 removal to lessen oxidative inclusions are the most important. The solution equilibria which retain these gases at a given partial pressure are known. This does not give information about the values actually attainable with the equipment required for outgassing today. A study was made to find the rate-determining factors and on the basis of the idea developed about the transport mechanism an estimate was made of the gas content theoretically attainable. These are the values which are attainable in practice, especially in vacuum induction melting and sweep outgassing. (tr-auth)

21906

TREATMENT OF STEEL IN VACUUM. L. Bangert (W. C. Heraeus GmbH, Hanau am Main, Ger.). p.577-87 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In German)

Qualitative improvement of steel by vacuum treatment depends on two phenomena: the gas content is reduced, and a good casting texture is obtained. As an example of the first a steel outgassing process is described and discussed. The second is treated using vacuum arc melting of a heat-resisting steel as an example. (T.R.H.)

21907

VACUUM TREATMENT OF MOLTEN STEEL. A NEW WAY OF IMPROVING CONVERTER STEEL PRODUCTION. A. M. Samarin and L. M. Novik. p.588-92 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In English)

Experience in the USSR with vacuum treatment of molten steel is related. Rail steel and rimming steel are greatly reduced in H_2, N_2, and O_2 content by 12 or 13 min at 5 to 10 mm Hg after the Bessemer converter treatment. The vacuum treatment is reliable and inexpensive and will promote the production of converter steel. (T.R.H.)

21908

A NEW METALLIC GETTER MATERIAL. E. Baronetzky

(Allgemeine Deutsche Philips Industrie GmbH, Aachen). p.646-7 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In German)

By addition of Ag and other noble metals to Th–Al the gas absorption properties at room temperature are improved. In particular the autocatalyzed H_2 gettering after oxidation by pure O_2 and the absorption of CO increase noticeably. In the system Th(Al, Ag), Th_2Al and Th_2Ag form an unbroken series of mixed crystals. (tr-auth)

21909

EVAPORATION OF ALUMINUM BY GRAPHITE EVAPORATOR. Y. Moriya (Tokyo Shibaura Electric Co., Ltd.). p.744-8 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In English)

The desirable properties of graphite for evaporation of aluminum were determined as follows: apparent density > 1.80 g/cm^3, true density > 2.15 g/cm^3, ashes < 0.05%. The destruction of graphite usually occurs at 1200–1300°C but it can be prevented by heating it at above 1500°C. (auth)

21910

EXTRACTIVE AND PHYSICAL METALLURGY OF PLUTONIUM AND ITS ALLOYS, INCLUDING A SPECIAL INTRODUCTION AND ANNOTATED BIBLIOGRAPHY BY W. D. WILKINSON, ARGONNE NATIONAL LABORATORY. W. D. Wilkinson, ed. New York, Interscience Publishers, 1960. 322p. $10.50.

A volume of 14 papers is presented on the metallurgy of Pu. Among the topics treated are conversion of Pu salts to the metal, extraction of Pu + impurities from nitric acid solution by tributyl phosphate, fused salt studies, removal of fission products from Pu, alloying behavior of Pu, Pu-Ce system, Pu-Zn system, alpha Pu, beta Pu, gamma Pu, etching of Pu, zone refining, and behavior of Pu alloys at high pressures. An annotated bibliography of 233 references, divided into seven sections of different subject matter, is given. Separate abstracts have been prepared for each paper. (D.L.C.)

21911

ALTERNATIVE ROUTES FOR THE CONVERSION OF PLUTONIUM SALTS TO METAL AND THEIR RECOVERY PROBLEMS. I. L. Jenkins, N. J. Keen, and A. G. Wain (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.25-42 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

The advantages and disadvantages of a number of methods for the preparation of plutonium metal are described with particular reference to the reduction of oxides, fluorides, and chlorides by calcium and lithium. The recovery of plutonium from the slags which are formed during these reductions is discussed. (auth)

21912

CALCIUM REDUCTION OF PLUTONIUM HALIDES TO METAL. R. D. Baker and W. J. Maraman (Los Alamos Scientific Lab., N. Mex.). p.43-59 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

Plutonium metal is prepared by calcium reduction of a halide of plutonium. The development of this process during the period 1943 to 1946 is reported. Methods and equipment used to prepare metal of greater than 99 wt.% purity in good yield from either plutonium(III) chloride or plutonium(IV) fluoride are presented. The effects of process variables such as reduction scale (varied from 1 to 500 g plutonium), the use of iodine as a booster, reduction temperature-time cycle, purity of halide, and crucible properties on the product yield and purity are also discussed. (auth)

21913

PREPARATION OF METALLIC PLUTONIUM. F. Anselin (Centre d'Etudes Nucléaires, Fontenay-aux-Roses, France). p.61-74 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson. ed. New York, Interscience Publishers, 1960.

The thermal reduction of plutonium fluorides by calcium is accomplished under inert atmosphere and without any booster by direct induction heating of compacted mixture in a calcium fluoride crucible. A detailed description of the laboratory process is given along with the discussion of yields and a typical analysis. (auth)

21914

METALLOGRAPHY OF ALPHA PLUTONIUM. P. Bardet, H. Monti, A. Robillard, and F. Sebilleau (Centre d'Etudes Nucléaires, Fontenay-aux-Roses, France). p.181-8 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

The preparation and examination of metallographic specimens of α-plutonium is done in gloveboxes. Specimen discs are cut off ingots with a lubricated wheel in an argon atmosphere and are resin mounted in contact with electrodes for possible electrolytic polishing. Mechanical polishing is done automatically on alloys and manually on pure plutonium with a series of carborundum and emergy papers and diamond abrasives. An anhydrous lubricant is used. Atmospheric or chemical oxidation facilitates examination in polarized light. Typical specimens prepared and observed under different conditions are illustrated and discussed. (auth)

21915

SOME EXPERIMENTS IN ZONE REFINING PLUTONIUM. R. E. Tate and R. W. Anderson (Los Alamos Scientific Lab., N. Mex.). p.231-42 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

The zone melting process was applied to plutonium containing known amounts of impurities, and the segregation of these impurities determined by chemical and spectrographic analyses. Rod specimens of plutonium were contained in thoria or carbide-coated tantalum boats. Each rod was passed horizontally through a single-turn, high-frequency coil in such a manner as to cause a narrow

molten zone to pass repeatedly through the rod. The impurity elements Al, Co, Cr, Fe, Mn, Ni, and Si were found to move in the directions predicted from the respective binary constitutional diagrams. (auth)

21916

ANNOTATED BIBLIOGRAPHY. W. D. Wilkinson ([Argonne National Lab., Lemont, Ill.]). p.263-307 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

An annotated bibliography of 233 references is given on plutonium metallurgy. The references are divided into seven sections with the following headings: (1) safe handling and nuclear properties, (2) preparation of plutonium metal and compounds, (3) physical metallurgy of plutonium, (4) plutonium fuel elements and fabrication, (5) plutonium ceramics, (6) plutonium hydrometallurgy, and (7) pyrometallurgical reprocessing. (D.L.C.)

21917

REACTOR HANDBOOK. SECOND EDITION REVISED AND ENLARGED. VOLUME I. MATERIALS. C. R. Tipton, Jr., ed. New York, Interscience Publishers, Inc., 1960. 1217p. $36.50.

Treatment of nearly all topics covered in the first edition was expanded and brought up to date and many new topics were added. The expansion reflects both growth and a very substantial declassification of data that has taken place during the last five years. The coverage was extended to include liquids and gases as well as solids, which were the exclusive consideration of the original materials volume. Information on irradiation behavior, generally unavailable for the first edition, is included. (W.D.M.)

21918

NEUTRONIC REACTOR CONTROL. H. Hurwitz, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,931,761. Apr. 5, 1960.

An apparatus is described for indicating the approach to prompt criticality of a neutronic reactor and comprises means for oscillating an absorber in the reactor, a detector for measuring neutron flux in the reactor, two channels into which the output of the detector can be directed, one of which includes a narrow band filter with band pass frequency equal to that of the oscillator, and means for indicating the ratio of the signal produced by the channel with the filter to the signal produced by the other channel, which constitutes an indication of the approach to prompt criticality.

21919

NEUTRONIC REACTOR. E. Fermi (to U. S. Atomic Energy Commission). U. S. Patent 2,931,762. Apr. 5, 1960.

A nuclear reactor is described consisting of blocks of graphite arranged in layers, natural uranium bodies disposed in holes in alternate layers of graphite blocks, and coolant tubes disposed in the layers of graphite blocks which do not contain uranium.

21920

DISSOLUTION METHOD OF REMOVING BONDING AGENTS. H. H. Hyman (to U. S. Atomic Energy Commission). U. S. Patent 2,933,421. Apr. 19, 1960.

A method is given for removing residual aluminum-silicon bonding agents from uranium slugs after the removal of aluminum coatings. To accomplish this the slug is immersed in an aqueous solution about 0.75 N in hydrofluoric acid and about 7 N in nitric acid.

21921

CONTROL ROD ALLOY CONTAINING NOBLE METAL ADDITIONS. W. K. Anderson and W. E. Ray (to U. S. Atomic Energy Commission). U. S. Patent 2,935,401. May 3, 1960.

Silver-base alloys suitable for use in the fabrication of control rods for neutronic reactors are given. The alloy consists of from 0.5 wt.% to about 1.5 wt.% of a noble metal of platinum, ruthenium, rhodium, osmium, or palladium, up to 10 wt.% of cadmium, from 2 to 20 wt.% indium, the balance being silver.

21922

STEAM FORMING NEUTRONIC REACTOR AND METHOD OF OPERATING IT. S. Untermyer (to U. S. Atomic Energy Commission). U. S. Patent 2,936,273. May 10, 1960.

The heterogeneous reactor is liquid moderated and cooled by a steam forming coolant and is designed to produce steam from the coolant directly within the active portion of the reactor while avoiding the formation of bubbles in the liquid moderator. This reactor achieves inherent stability as a result of increased neutron leakage and increased neutron resonance absorption in the U^{238} fuel with the formation of bubbles. The invention produces certain conditions under which the formation of vapor bubbles as a result of a neutron flux excursion from the injection of a reactivity increment into the reactor will operate to nullify the reactivity increment within a sufficiently short period of time to prevent unsafe reactor operating conditions from developing. This is obtained by disposing a plurality of fuel elements within a mass of steam forming coolant in the core with the ratio of the volume of steam forming coolant to the volume of fissionable isotopes being within the range yielding a multiplication factor greater than unity and a negative reactivity to core void coefficient at the boiling temperature of the coolant.

21923

METHOD OF PRODUCING NIOBIUM METAL. H. A. Wilhelm and E. R. Stevens (to U. S. Atomic Energy Commission). U. S. Patent 2,937,939. May 24, 1960.

A process is given for preparing ductile niobium metal by the reduction of niobium pentoxide with carbon. The invention resides in the addition, to the reaction mass, of from 0.05 to 0.4 atom of titanium (in the form of metallic titanium, titanium carbide, and/or titanium oxide) per one mole of niobium pentoxide. The mixture is heated under subatmospheric pressure to above 1300°C but below the melting point of niobium, and the carbon- and oxygen-free niobium sponge obtained is cooled under reduced pressure.

21924

METHOD OF MAKING UO_2–Bi SLURRIES. H. T. Hahn (to U. S. Atomic Energy Commission). U. S. Patent 2,937,982. May 24, 1960.

A process is given of preparing an easily dispersible slurry of uranium dioxide in bismuth. A mixture of bismuth oxide, uranium, and bismuth are heated in a capsule to a temperature over the melting point of bismuth oxide. The amount of bismuth oxide used is less than that stoichiometrically required because the oxygen in the capsule also enters into the reaction.

21925

METHOD OF MAKING REFRACTORY BODIES. J. C. Andersen (to U. S. Atomic Energy Commission). U. S. Patent 2,938,807. May 31, 1960.

A method is given for the manufacture of silicon carbide bodies that are characterized by high density, high purity, and superior resistance to oxidative deterioration. Dense silicon bodies are obtained by a process in which granular silicon carbide, a carbonizable material, and a carbonaceous material are mixed together, the mixture is shaped as desired, and then the shape is fired in the presence of more than the stoichiometric amount of silicon. The carbonizable material preferably includes a temporary binder that is set before the firing step to hold the mix in shape for firing.

21926

HIGH PRESSURE DIES. W. B. Wilson (to U. S. Atomic Energy Commission). U. S. Patent 2,938,998. May 31, 1960.

A press was invented for subjecting specimens of bismuth, urania, yttria, or thoria to high pressures and temperatures. The press comprises die parts enclosing a space in which is placed an electric heater thermally insulated from the die parts so as not to damage them by heat. The die parts comprise two opposed inner frustoconical parts and an outer part having a double frustoconical recess receiving the inner parts. The die space decreases in size as the inner die parts move toward one another against the outer part and the inner parts, though very hard, do not fracture because of the mode of support provided by the outer part.

Corrosion

21927 ANL-6070

Argonne National Lab., Ill.

AQUEOUS CORROSION OF MAGNESIUM ALLOYS. S. Greenberg and W. E. Ruther. May 1960. 18p. Contract W-31-109-eng-38. OTS.

The aqueous corrosion of Mg alloys was investigated at 53 to 150°C. Corrosion rates rose rapidly with temperature, reaching about 3 mils per day at 150°C for AZ-31 [Mg-2.5 to 3.5 wt.% Al-0.7 to 1.3 wt.% Zn-0.2 wt.% Mn]. Additions of small amounts of Cu and/or Ni to the basic AZ-31 composition reduced the corrosion rate at 150° by a factor of about two. Sn may be advantageously substituted for Zn in AZ-31. Control of the pH in the range between 6 and 7 and maintenance of a fluoride concentration in the range between 1 and 10 ppm reduced the corrosion rate of AZ-31 to about 0.1 mil per day at 150°C. (auth)

21928 CEA-1387

France. Commissariat à l'Énergie Atomique, Centre d'Etudes Nucleaires, Saclay.

CONTRIBUTION A L'ETUDE DE LA CORROSION DU ZIRCONIUM ET DU ZIRCALOY-2 DANS LA VAPEUR D'EAU SURCHAUFFEE à 400°C (105 kg/cm^2). (Contribution to the Study of Corrosion of Zirconium and Zircaloy-2 in Superheated Steam at 400°C (105 kg/cm^2). H. Coriou, J. Gauduchau, L. Grall, J. Hure, and M. Pelras. 1959. 18p.

The corrosion kinetics of Zircaloy-2 in water and steam at temperatures between 300 and 400°C are represented by a curve sharply divided into two stages separated by a so-called transition point. After a first period of decreasing corrosion rate there follows a second period with much faster kinetics in which the speed is constant. After carrying out a methodical study of the corrosion of Zircaloy-2 in the form of sheets and tubes, we have demonstrated, at 400°C in steam, a systematic anomaly which appears at the transition point. The curve presents three quite distinct points; after the first period a fast corrosion is observed, followed by a third period at a slower speed. This leads us to believe that there may be not a single point but a transition zone, separating two types of kinetic behavior and corresponding to modifications in the properties of the oxide layer. After this readjustment period a new corrosion law is established, lasting a considerable time, the corrosion speed being slower than that indicated so far. A study of the morphology of the oxide films which develop under these conditions has demonstrated the special part played by mechanical, physical, and metallurgical factors in the case of zirconium. Deep penetration of oxide can thus show up on the inner wall of hammer-hardened tubes. Simultaneously a very considerable hydride formation occurs in the metal. (auth)

21929 HW-63872

General Electric Co., Hanford Atomic Products Operation, Richland, Wash.

COMPARISON OF THE CORROSION OF CARBON STEEL, STAINLESS STEEL, INCONEL-X, MONEL AND STELLITE IN THE KER MOCK-UP TUBES WITH OUT-OF-REACTOR LOOPS. A. P. Larrick. Feb. 17, 1960. 15p. OTS.

Water corrosion tests were run on carbon steel (A-212), stainless steel (304), Monel, Inconel-X, and Stellite-12 in KER-1 and KER-2 in-reactor recirculating loops with the NPR as the reactor. The water was adjusted to pH 10 and 4.5 with LiOH and H_3PO_4, respectively. The data were compared with those obtained in small out-of-reactor corrosion test loops and found to be about the same except for Monel, for which no out-of-reactor loop tests were run. There is considerable scatter in the data. (D.L.C.)

21930 KAPL-2000-9(p.B.35-B.38)

Knolls Atomic Power Lab., Schenectady, N. Y.

EFFECT OF UNTEMPERED MARTENSITE ON SUSCEPTIBILITY OF AISI 410 STEEL TO STRESS-CORROSION CRACKING. H. Suss. 4p.

AISI 410 steel austenitized at 1750 to 1850°F, air-cooled to room temperature, and tempered at 1125°F for 4 hr is not susceptible to stress-corrosion cracking when exposed to air-saturated water at 300°F, controlled oxygenated water at 300 to 600°F, hydrogen–ammonia at 300 to 600°F, and hydrogen–lithium hydroxide at 300 to 600°F. (W.L.H.)

21931 KAPL-M-JPH-20

Knolls Atomic Power Lab., Schenectady, N. Y.

CORROSION OF ALUMINUM IN DILUTE AQUEOUS SOLUTIONS. John P. Howe. [1948]. Decl. June 14, 1956. 26p. Contract W-31-109-Eng-52. OTS.

Corrosion studies of Al in water containing small amounts of H_2O_2 were made. The tests were performed under flow rates of 7 to 38 ft/sec at 95°C. (C.J.G.)

21932 NAA-SR-Memo-4845

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

OXIDATION RATES OF U–10 wt.% Mo IN AIR. J. Gioseffi. Jan. 6, 1960. 12p. OTS.

Oxidation rates of uranium–10 wt.% molybdenum fuel elements in air were determined at 600 and 900°F. Rates were established in both as-cast and gamma heat treated materials by weight change measurements on duplicate specimens at various exposure intervals to a total of 24 hours exposure. At 600°F there was some degree of protectiveness due to the formation of a surface oxide film. Weight change data assumed a parabolic relationship with exposure time. Oxidation rates were higher at 900°F. With the exception of some slight deviations during early stages of exposure, weight change data assumed a linear rate with exposure time. (M.C.G.)

21933 NP-8936

Central Inst. for Industrial Research, Blindern, Norway.
OXIDATION STUDIES OF NIOBIUM BASE ALLOYS. Technical (Scientific) Note No. 3 [for] April 1, 1959 to March 31, 1960. Per Kofstad, Hallstein Kjøllesdal, and Nico Norman. May 1960. 66p. Contract AF61(052)-90. (SI-publ.-283).

Oxidation of binary, ternary, and quaternary niobium alloys, mostly involving Nb–25 at.% Ti as base alloy, was studied at temperatures of 600, 900, and 1200°C and at oxygen pressures of 760 and 0.1 mm of Hg. The studies involve semicontinuous oxidation rate measurements and x-ray diffraction, electron microscopy, and metallographic investigations on oxidized specimens. (auth)

21934 NRL-5427

Naval Research Lab., Washington, D. C.
STEEL CORROSION MECHANISMS UNDER CONDITIONS PERTINENT TO STEAM POWER GENERATION. M. C. Bloom and Mary Boehm Strauss. Dec. 30, 1959. 54p. (AD-232430).

The corrosion of steel at temperature and pressure conditions encountered in boiler operation was investigated. X-ray-diffraction studies were performed on the following pit formation mechanisms: (1) corrosion-product formation and pitting phenomena in sealed mild steel capsules containing pure water at room and at boiler temperatures at several oxygen levels; (2) transformation and stability phenomena of the corrosion products; (3) effects in commercial piping at low flow rates; and (4) effects of water treatment chemicals. The studies revealed that the protective film on steel under conditions pertinent to boiler operation has the spinel structure and that the major concern is the genesis and preservation of this film. Films of this kind may be produced at room temperature by reaction of steel in the absence of oxygen. In the presence of air-saturated water, however, the initial product generated is γ-FeOOH, a loosely adherent material some of which appears as islands on the steel surface, each island being the nucleus of an incipient pit. As the corrosion proceeds and the oxygen is consumed, the pH rises with gradual elimination of γ-FeOOH and its replacement by a spinel film on the metal surface. Most of the γ-FeOOH remained as a suspension in the solution or as settled agglomerated masses. Appreciable quantities of this material during boiler shutdown periods and non-removal prior to resumption of boiler operations would result in conversion to red α-Fe_2O_3, a nonadherent insulating powder which could gather at low-velocity areas and produce hot spots or interfere with protective film formation. (auth)

21935 NYO-7925

Aeroprojects, Inc., West Chester, Penna.
ULTRASONICALLY ACCELERATED DISSOLUTION OF HIGH-TEMPERATURE AND CORROSION-RESISTANT METALS. J. L. Straughn and W. B. Tarpley. May 1958. Decl. Mar. 16. 1960. 16p. Contract AT(30-1)-1836. OTS.

Investigations on the ultrasonically enhanced dissolution of fuel-element claddings were extended to include three candidate high-temperature-resistant alloys: Nichrome, Inconel X, and Kanthal. Nitric, sulfuric, and halogen-containing acids, both alone and in combination, were examined as dissolution media. Considerable dissolution rate improvement was demonstrated on all three alloys in the nitric-hydrochloric acid system by ultrasonic vibration of the sample specimens at power input levels of 200 to 1000 watts. The same technique resulted in increased rate of dissolution of Kanthal in sulfuric acid solution. Direct ultrasonic vibration of the cladding metal was found to be more effective than the close-proximity approach. (auth)

21936 TID-5935

Battelle Memorial Inst., Columbus, Ohio.
THE CORROSION OF HyMu 80 FLUORINATORS. F. W. Fink. May 31, 1960. 28p. OTS.

Results of a series of fluorination studies conducted in containers fabricated from HyMu 80 (Ni–80 wt.%, Fe–16 wt.%, Mo–4 wt.%) are summarized. The fluorinators were charged with fluoride salts of composition such as UF_4, 50 Na–50 ZrF_4, or 31 LiF–24 NaF–45 ZrF_4 given in mole %. Corrosion coupons of HyMu 80 and A nickel were included in the salt. Metallographic examinations were made on the containers and coupons. (J.R.D.)

21937

THE BREAKDOWN OF THE PROTECTIVE OXIDE FILM ON TRANSITION METAL ALLOYS. W. W. Smeltzer (McMaster Univ., Hamilton, Ont.). Acta Met. 8, 268-70 (1960) Apr.

Initial breaks in oxidation curves of iron–chromium alloys were found to be associated with the ferrite–austenitic phase transformation. This transformation was caused by preferential oxidation of chromium at a rate much larger than its replenishment by diffusion to the metal–oxide interface. The stress resulting from this transformation caused breakdown of the protective oxide film. Results indicated that continuous oxidation curves for iron–chromium alloys could be obtained under conditions where preferential oxidation of an alloy constituent did not cause the ferritic–austenitic phase transformation. (M.C.G.)

21938

OXIDATION AND CORROSION OF ZIRCONIUM AND ITS ALLOYS (OXIDE FILM BREAKDOWN IN ARC-MELTED SPONGE ZIRCONIUM). Brian Cox (Atomic Energy Research Establishment, Harwell, Berks, England). Corrosion 16, 380t-4t(1960) Aug.

In contrast to the mode of breakdown in Zircaloy-2 and carbon-melted Zirconium the oxide film on arc-melted zirconium corroded in steam or water at 300°C fails initially as a result of more rapid oxidation along grain boundaries. Stresses set up in the oxide film by this preferential attack along grain boundaries cause cracking of the film parallel to the grain boundaries. Subsequent failure within the grains causes the final disintegration of the oriented protective oxide and its replacement by a loose coating of unoriented ZrO_2. (auth)

21939

STUDY OF CORROSIVE AND ELECTROCHEMICAL BEHAVIOR OF STAINLESS STEELS BY CATHODIC POLARIZATION IN NITRIC ACID SOLUTIONS. I. PECULIARITIES RELATING TO SELF-DISSOLUTION OF STEELS. E. N. Mirolyubov, M. M. Kurtepov, and N. D. Tomashev (Inst. of Physical Chemistry, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 6, 1015-21(1960) June. (In Russian)

The cathodic dissolution of stainless steel in nitric acid is studied in relation to potential, acid concentration, and temperature. The self-diffusion process in stainless steel in nitric acid solutions inhibits dissolution by slowing the supply of acid to the steel surface. (R.V.J.)

21940

THE OXIDATION OF ZIRCONIUM CARBIDE IN HIGH-TEMPERATURE COMBUSTION GASES. W. Watt (Royal Aircraft Establishment, Farnborough, Hants, Eng.). Powder Met. No. 1-2, 227-34(1958).

The reactions of sintered zirconium and titanium car-

bides were studied in simulated rocket combustion gases at surface temperatures of about 2250°C. Under these conditions zirconium carbide is oxidized according to a parabolic law owing to the formation of an adherent oxide film. No oxide film is formed on titanium carbide under the same conditions, and it decreases in weight and dimensions at a relatively rapid rate. (auth)

21941

CORROSION OF ALUMINUM AND ITS ALLOYS IN WATERS OF VARIOUS COMPOSITIONS. Otakar Sverepa (G. W. Akimow Staatl. Forschungsinstitut für Materialschutz, Prague). p.76-9 of "Korrosion 12. II. Kongress der Europäischen Föderation Korrosion in Frankfurt/Main vom 31. Mai bis 8. Juni 1958. Korrosion und Chemie." Weinheim/Bergstr., Ger., Verlag Chemie GmbH, 1960. 296p. (In German)

Corrosion tests on aluminum and its alloys in river water and in the water of cooling systems were made under natural conditions. In river water corrosion was low and uniform, but pitting corrosion occurred in circulating water. The composition and impurities of the water have a great effect on the corrosion. The difference in the corrosion of the different materials was slight. Laboratory tests showed that Al–Mn and Al–Mg alloys suffered the most extensive corrosion by the combined action of copper, chlorine, calcium, and bicarbonate ions in the presence of oxygen. Pitting corrosion depends primarily on the concentration of these ions. The weight loss, number of holes on the surface, maximum corrosion depth, and nature of the corrosion products were determined as a function of the pH and the concentration of the ions cited. (tr-auth)

21942

THEORY OF THE CORROSION OF TITANIUM. W. R. Fischer (Fried. Krupp Widia-Fabrik, Essen, Ger.). p.98-104 of "Korrosion 12. II. Kongress der Europäischen Föderation Korrosion in Frankfurt/Main vom 31. Mai bis 8. Juni 1958. Korrosion und Chemie." Weinheim/Bergstr., Ger., Verlag Chemie GmbH, 1960. 296p. (In German)

With the aid of a current-voltage diagram, definite ranges of potential difference can be determined, each of which characterizes special corrosion conditions for titanium. Above the minimum corrosion potential, titanium can be rendered chemically inactive by coating with a layer of titanium hydride. This condition is reached normally in the presence of strong cathodic polarization only. If a critical potential difference is exceeded, the metal becomes chemically active. Corrosion and hydrogen generation occur. After the critical potential difference for passivity is passed, the metal is covered with an oxide layer which again makes it inactive. This is the condition responsible for the excellent corrosion-resistance properties of titanium in oxidizing media. With relatively high potential differences, which occur only by anodic polarization and not in oxidizing media, activation again occurs in halogen solutions. Titanium is attacked in the form of scars. In solutions free from halogens there is no corrosion at strong anodic polarization. The corrosion behavior of titanium at various potential difference ranges is illustrated with characteristic examples. (tr-auth)

21943

METHOD FOR PROTECTING MAGNESIUM AND ITS ALLOYS AGAINST HIGH TEMPERATURE OXIDATION. (to Commissariat à l'Énergie Atomique). French Patent 1,195,420. May 19, 1959.

Magnesium and its alloys, e.g., fuel element cans, are protected against oxidation by adding 2 to 3 γ/l fluorine to the oxidizing atmosphere in the form of volatile compounds, e.g., HF, Freon, and trifluoromethylbenzene. Owing to the formation of a protective MgF_2 layer, the working temperature may be increased by 150°C. The protection persists in the presence of nuclear reactor radiation and humidity.

Fabrication

21944 AD-232423

Crucible Steel Co. of America. Midland Research Lab., Penna.

MANUFACTURING METHODS FOR COLUMBIUM ALLOY FORGINGS. PHASE I: STATE OF THE ART REPORT. Interim Report No. 1. R. O. Carson, Paul F. Darby, and M. E. Taylor. Nov. 30, 1959. 93p. Contract AF33(600)-39944.

With this is bound: Union Carbide Metals Co. THE PROCESSING AND PROPERTIES OF COLUMBIUM-BASE SHEET AND FORGING ALLOYS. A STATE-OF-THE-ART SURVEY. F. E. Bacon, R. W. Fountain, W. F. Sheely, J. L. Wilson, and S. T. Wlodek. Dec. 2, 1959. Contract AF33(600)-39942 and 39944.

The state of the art of Nb-base alloys is reviewed. A general discussion of the consolidation and ingot conversion practice, mechanical and physical properties, and oxidation kinetics is presented. Consolidation by arc-melting is emphasized in the discussion. Primary ingot breakdown was achieved most readily by hot extrusion but some alloy ingots have been successfully hot forged. Further working was done by rolling or swaging at elevated temperatures in most cases but at room temperature in a few cases. Protection of the hot alloy from the atmosphere during working is not essential but facilitates working and increases yield. It is convenient to classify the alloys as high-, medium-, or low-strength on the basis of their tensile strengths at high temperatures. The creep-rupture data available are consistent with this classification. Preliminary data indicate that at least some alloys can be strengthened by heat-treatment. Factors other than strength, such as oxidation resistance or workability, may alter the order of relative merit from the order of strengths. Reaction of the alloys to oxygen or air at elevated temperatures was characterized using weight gain and metal loss as a measure of oxidation rate and by metallographic techniques to determine the depth of hardening. Current metallographic practice is reviewed and data sheets containing a summary of information on the individual alloys are presented. (auth)

21945 BMI-1451

Battelle Memorial Inst., Columbus, Ohio.

THE BONDING OF MOLYBDENUM- AND NIOBIUM-CLAD FUEL ELEMENTS. Stan J. Paprocki, Edwin S. Hodge, and Paul J. Gripshover. July 12, 1960. 64p. Contract W-7405-eng-92. OTS.

A solid-state bonding technique involving the use of gas pressure at elevated temperatures was utilized for the self-bonding of molybdenum and niobium. Bonding conditions and surface preparation as a function of the integrity of the bond achieved were evaluated for each material. Optimum self-bonding of niobium was achieved by bonding parameters of 2100 to 2300°F at 10,000 psi for 3 hr with surfaces which had been prepared by etching in a nitric-hydrofluoric acid solution prior to bonding. The process as developed was used to prepare niobium-clad flat-plate- and rod-type fuel elements and flat-plate subassemblies. Niobium tubing was also fabricated by this technique. Molyb-

denum self-bonding was most readily achieved by gas-pressure bonding at temperatures of 2300 to 2600°F at 10,000 psi for periods of 3 hr. With these bonding conditions a number of different surface preparations were satisfactory. Directional ductility of the molybdenum was encountered after bonding and methods to eliminate this were evaluated. Cross rolling with respect to the original rolling direction was shown to improve the ductility of molybdenum-clad specimens. (auth)

21946 BRB-20
Bridgeport Brass Co., Conn.
EXTRUSION OF URANIUM FOR HANFORD CORED SLUG PROGRAM—VII. G. T. Murray and R. M. Treco. Feb. 1956. Decl. Mar. 30, 1960. 28p. Contract AT(30-1)-1405. OTS.

Development of extrusion as a means of making Hanford cored slugs was continued. Eccentricities of the thick-wall tubes required were a major problem in meeting an arbitrary specification of 0.032-in. This eccentricity is defined as the difference between centers of the inside and outside diameters. A new method of insuring better concentricity is described which involves a special type of dummy block. A series of heat-treated uranium dingots were also extruded as rod and found to require lower pressures than normal vacuum cast uranium. (auth)

21947 DMIC-131
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
NEW DEVELOPMENTS IN THE WELDING OF METALS. P. J. Rieppel. June 24, 1960. 53p. Contract AF18(600)-1375. (PB-151089). OTS.

New developments in concepts and modifications to fusion and resistance welding processes, high-temperature brazing, and solid-state bonding processes are discussed. (C.J.G.)

21948 KAPL-1335
Knolls Atomic Power Lab., Schenectady, N. Y.
ALUMINUM CANNING OF NICKEL-PLATED, HANFORD FOUR-INCH URANIUM FUEL SLUGS BY HOT-PRESSING. H. T. Sumsion, C. J. Beck, and L. S. DeLuca. May 17, 1955. Decl. Mar. 16, 1960. 36p. Contract W-31-109-Eng-52. OTS.

Conditions of time, temperature, and pressure for hot-press bonding of aluminum–nickel and uranium–nickel disks were determined experimentally. A process for jacketing Hanford four-inch slugs, coated with nonporous nickel electroplates, in aluminum cans by cold-sizing and hot-pressing was developed and conditions of time, temperature, and pressure required for the actual canning process were determined. (auth)

21949 KAPL-1424
Knolls Atomic Power Lab., Schenectady, N. Y.
ZIRCONIUM COATING OF URANIUM BY IODIDE DECOMPOSITION. W. L. Robb and A. C. Schafer. Dec. 6, 1955. Decl. Mar. 16, 1960. 72p. Contract W-31-109-eng-52. OTS.

The deposition of corrosion-resistant Zr coatings on U fuel elements by the deBoer iodide decomposition process is described. Cost estimates for production facilities are presented. Results of corrosion tests and metallographic examination reveal more diffusion between Zr coatings deposited on U–Zr alloys than between Zr deposited on pure U. (auth)

21950 KAPL-1670
Knolls Atomic Power Lab., Schenectady, N. Y.
FABRICATION OF URANIUM-RICH, URANIUM–ZIRCONIUM DISPERSION FUELS BY HYDROSTATIC HOT PRESSING. R. N. Honeyman. Nov. 14, 1956. Decl. Mar. 16, 1960. 32p. Contract W-31-109-eng-52. OTS.

A hydrostatic hot pressing, powder metallurgy process for consolidating spherical U particles in a Zr matrix was developed. Fully dense compacts containing up to 60 vol. % of U uniformly dispersed throughout the Zr matrix were obtained by this process. (auth)

21951 KAPL-2000-9(P.A.1-A.M.)
Knolls Atomic Power Lab., Schenectady, N. Y.
ARC WELDING OF INCONEL FOR NUCLEAR POWER PLANTS. J. Bland, W. A. Owczarski, et al. 19p.

A welding program was undertaken to determine if the necessary butt welds and weld overlays could be made successfully for the reactor components and to determine the advantages and disadvantages associated with the various welding products and processes. The evaluation program covered structural welding and weld overlays; some study was made of the effects of postweld heat treatments. The structural welding work investigated the deposit soundness and mechanical properties of the Inconel-type filler metal in $1\frac{1}{8}$-in. thick-butt joints. The overlap work included an evaluation of the mechanical properties and soundness of covered electrode and inert-gas-shielded arc welded overlays on carbon steel. (W.L.H.)

21952 KAPL-M-JDC-1
Knolls Atomic Power Lab., Schenectady, N. Y.
BRAZING INCONEL-SHEATHED THERMOCOUPLES TO INCONEL STRUCTURAL PLUGS AND SEAL COLLARS. J. D. Carey and A. J. Palmer. July 13, 1960. 12p. Contract W-31-109-Eng-52. OTS.

Inconel-sheathed chromel-alumel thermocouples were brazed to Inconel plugs and seal collars for temperature measurements in D1G reactor instrumentation. The two brazing alloys used were 82% Au–18% Ni wire and 19% Cr, 10% Si, 4% Fe, 1% Mn, and 66% Ni powder. Brazing was done by heating in a quartz system in which both vacuum and argon were used for protection. No significant variation in post-braze thermocouple response was observed with either of the brazing alloys. Mass spectrometer leak testing at 2500 psi indicated no leaks in any of the brazed joints. Bend tests showed no flaking or cracking. (M.C.G.)

21953 LA-2250
Los Alamos Scientific Lab., N. Mex.
THE USE OF QUARTZ TUBES FOR SAMPLING AND CASTING PLUTONIUM. K. W. R. Johnson and J. W. Anderson. Aug. 1958. Decl. Mar. 16, 1960. 16p. Contract W-7405-eng-36. OTS.

The use of quartz tubing for sampling molten plutonium and for casting rods is described. These procedures offer cheap and easy-to-use methods for obtaining molten samples and for casting long rods with small diameters. (auth)

21954 NAA-SR-5120
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
HOT PRESSURE BONDING OF OMR TUBULAR FUEL ELEMENTS. E. E. Garrett, G. V. Alm, and M. H. Binstock. July 30, 1960. 47p. Contract AT-11-1-GEN-8. OTS.

A double-concentric, tubular fuel element, consisting of finned aluminum cladding bonded to uranium alloy core tubes, was designed for the Piqua Organic Moderated Reactor (OMR). Claddings were of extruded aluminum tubes containing finned surfaces. The fuel core was a cast, tubular, U–3.5 wt.% Mo–0.1 wt.% Al alloy containing a 1-mil surface coating of nickel. Full-scale prototype sections were fabricated, using isostatic bonding conditions of 7000 psi, at 1000°F, for 22 min. The development neces-

sary to achieve core-to-clad bonding in this fuel configuration is described in detail. (auth)

21955 NASA-TN-D-303

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

THE HOT-PRESSING OF HAFNIUM CARBIDE (MELTING POINT, 6030°F). William A. Sanders and Salvatore J. Grisaffe. Aug. 1960. 15p. OTS.

The effects of some hot-pressing variables (temperature, pressure, and time) on the density and grain size of ¼-inch-thick hafnium carbide disks are examined. Bodies of approximately 98% theoretical density can be produced at 4230°F, 3500 lb/in.^{2}, in 15 minutes. (auth)

21956 NLCO-697

National Lead Co. of Ohio, Cincinnati.

INGOT MOLD HEATING AS A METHOD OF CONTROLLING METAL QUALITY. Earl B. Blasch, Galen F. Jennings, and George E. Wuller, Jr. Sept. 16, 1957. Decl. Mar. 30, 1960. 47p. Contract AT(30-1)-1156. OTS.

A process was developed on a pilot plant scale for vacuum-casting U ingots, using liquation techniques with heated molds. In an experiment designed to statistically evaluate the effects of mold heating and associated melting techniques, marked increases in metal quality were achieved. The improved methods of vacuum-casting U ingots were demonstrated to give more economical production of metallic fuel elements. (auth)

21957 NP-8911

Beryllium Corp., Reading, Penna.

BERYLLIUM CASTING. PHASE II. Interim Technical Report No. 7 [for] March 18, 1960—June 17, 1960. Paul M. Cohen and R. C. Harris. 29p. ASC Project 7-643. Contract AF33(600)-37902.

Additions of TaN (5 to 10%) did not produce any grain refinement in cast Be. No W was detected in melts to which WC was added. Some improvement in casting soundness resulted from the use of Ag as an alloying condition; grain refinement did not occur. Step castings, using rapid cooling methods, were cold rolled and recrystallized to a fine, equiaxed grain size. (For preceding period see NP-8797.) (C.J.G.)

21958 NYO-9184

Nuclear Materials and Equipment Corp., Apollo, Penna.

QUARTERLY PROGRESS REPORT [NO. 2 COVERING] PERIOD FEBRUARY 16, 1960 TO MAY 15, 1960. 30p. Contract AT(30-1)-2264. OTS.

Conditions required for the complete reduction of VCl_4 were determined. The best results for the deposition of V on UO_2 and U spheres were obtained at a reactor temperature of ~1000°C and using Ar as carrier gas. Experiments were performed which showed that the deposition of Si on UO_2 spheres is feasible. Cr coatings, laid down from $CrCl_2$, were dense, non-porous, and adherent but not completely continuous. The direct coating of UO_2 spheres by H reduction of $CrCl_3$ resulted in a "chloride" attack of UO_2. Very satisfactory Cr coatings were produced on UO_2 and U from chromium dicumene. Excellent coatings of Mo on UO_2 were obtained from $MoCl_5$ at a furnace temperature of 820°C and using H as a carrier. Mo was deposited at the rate of 1μ/hr on 100g of 100 mesh spheres. Cylinders, disks, and plates were formed from UO_2 spheres coated with Nb and the interstices between the spheres filled with Nb. By using stainless steel wire mesh as the mold, more than 80% of the voids were filled with Nb. Analytical techniques were developed for the analysis of W coatings on UO_2. (For preceding period see NYO-2804.) (C.J.G.)

21959 SEP-79

Sylvania Electric Products, Inc. Metallurgical Labs., Bayside, N. Y.

THE CANNING OF UO_3 POWDER FOR SAMPLING. H. H. Hausner, J. L. Zambrow, and S. Storchheim. Nov. 13, 1951. Decl. Feb. 16, 1960. 17p. Contract AT-30-1-GEN-366. OTS.

A method, based on powder-metallurgical procedures, was developed for canning uranium oxide powder in aluminum cans. A density of 5 gm/cc or higher was achieved by this method, with powder density variations of about 1% within the can. The oxide contaminated with cadmium compounds was canned by the same procedure with satisfactory results. Recommendations for production procedures are included. (auth)

21960 SEP-180

Sylvania Electric Products, Inc. Atomic Energy Div., Bayside, N. Y.

HYDROSTATIC PRESSING OF METAL POWDERS. C. A. Meyers and W. G. Lidman. Sept. 20, 1954. Decl. Feb. 16, 1960. 21p. Contract AT-30-1-GEN-366. OTS.

Hydrostatic pressing was investigated as a method of fabricating long preforms made from uranium powder. A laboratory scale pressure vessel was constructed to evaluate the feasibility of this process. Various metal powders were loaded into flexible molds and subjected to pressure in an enclosed liquid. The high density of uranium caused the flexible molds to distort during filling and after pressing there was a tendency for the compact to adhere to the mold. Methods of minimizing these difficulties are suggested. Uranium powder, compacted in a plastic mold at 21 tsi had a density of 12.5 g/cc. During the course of the investigation, it was found that hydrostatic pressing of other metal powders presented advantages over conventional steel die methods, especially in the ability to press experimental shapes using economical equipment. Recommendations were made for further development work on both cold and hot hydrostatic pressing. (auth)

21961 SEP-181

Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.

CANNING NICKEL-PLATED URANIUM SLUGS IN ALUMINUM. J. Storchheim, J. W. Nylin, P. Eisenberg, and G. Howland. Jan. 10, 1955. Decl. May 4, 1960. 31p. OTS.

Procedures are described for a newly developed method of plating wrought uranium slugs and of canning them in aluminum. Details are given of electroplating with nickel, preparing and hot-pressing the cans and slugs, and of final processing and both destructive and nondestructive testing of the canned specimens. The nickel is shown to be a mechanically strong bonding agent. Results were reproducible, and in a pilot run of several hundred slugs only 6.6% were rejected for defects. (auth)

21962 Y-1302

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

A METHOD FOR HOT-PRESSING LARGE DIAMETER BERYLLIUM OXIDE RINGS. L. M. McLaughlin and A. H. Ballard. May 31, 1960. 14p. Contract W-7405-eng-26. OTS.

A method for hot-pressing thin-wall BeO cylinders to high density and close tolerances with lengths to 4.63 in. and diameters to 10.5 in. is presented. The results of several nondestructive tests are given. (auth)

21963

A PROCESS FOR PREPARING BORON—PARAFFIN

SHIELDING BLOCKS. A. F. Steinegger (Institut für Reaktorforschung, Würenlingen, Switzerland). Neue Tech. 2, No. 6-7, 11-13(1960) June-July. (In German)

A method for the production of paraffin–boric acid neutron shielding blocks is described. The paraffin is grated to particles of 2 to 3 mm size and mixed for about 30 minutes with the boric acid (ratio of blend 5:1). The mixture is pressed into blocks with a pressure of 80 to 85 kg/cm^2. The method allows the reduction of the working time needed to one third compared to a casting method (paraffin and boric acid layers). The paraffin blocks have a crushing strength of 14 to 15 kg/cm^2. (auth)

21964

THE CONSOLIDATION OF METAL POWDERS BY HOT WORKING WITHIN SHEATHS. J. Williams (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Powder Met. No. 1-2, 94-103(1958).

Hot consolidation of metal powders within metal sheaths makes available a number of methods for the production of a wider variety of shapes and sizes than is possible with the normal powder-metallurgical techniques. Chemically reactive metal powders can be densified without the need for special atmospheres. The dimensional accuracy of the finished shapes will not be as great as for other consolidation techniques, but they can still be controlled to within narrow limits, which vary with the hot-working technique employed. The sheath has to be expendable and this, together with its fabrication and stripping costs, adds to the cost of the finished article. Sheath-working techniques have found their widest application in the nuclear-energy field, where the cost of the powder being consolidated is generally high compared with that of the sheath, and where the powder is chemically reactive and often presents a health hazard. (auth)

21965

THE PRESSURELESS SINTERING OF LOOSE BERYLLIUM POWDER. T. R. Barrett, G. C. Ellis, and R. A. Knight (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Powder Met. No. 1-2, 122-32(1958).

A new technique, termed pressureless sintering, was developed and established on a production basis. It allows the consolidation of beryllium powder to high densities without the application of pressure. The technique seems to offer notable advantages over the commercial process of powder consolidation by vacuum hot pressing. The technique appears to lend itself admirably to the production of various components for reactor application. The sintered metal may be used in the machined condition or after maximum property development by fabrication to sheet or tube forms. Particular significance is attached to the possibility of direct fuel-element production by sintering the powder around an uranium–ceramic core. (auth)

21966

ZONE SINTERING. J. Antill and M. Gardner (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Powder Met. No. 1-2, 133-42(1958).

A method of firing called "zone sintering" was developed which is analogous to that of zone melting. The technique consists of steadily passing a furnace at the sintering temperature (i.e., below the melting point of the material) over the "green-wave." The scope of the process is considerable, as it is possible to sinter, in a small inexpensive furnace, metal and ceramic tubes and rods with little restriction on their length. The method was applied to thorium, uranium, and "Hylumina" (an alumina-base refractory). The advantages and limitations indicated by the results of these applications are discussed. (B.O.G.)

21967

CONTINUOUS COMPACTION BY CYCLIC PRESSING. C. Deibel, D. R. Thornburg, and F. Emley (Westinghouse Electric Corp., East Pittsburgh, Penna.). Powder Met. No. 5, 32-44(1960).

A process recently developed produces wide, thick bars of unlimited length from powder, granular, or sponge raw materials by a cyclic pressing operation. The process can be adapted readily for laboratory study or for large-scale production. Many materials were pressed by this technique, and in all cases compaction was similar to that experienced in conventional pressing. Work on the pressing, sintering, and subsequent working of various nickel powders and of a nickel–iron–molybdenum magnetic alloy was carried out. Carbonyl nickel powder produces nickel strip of high quality. A high-permeability alloy containing nickel-79, iron-17, and molybdenum-4% can be made into strip with good magnetic properties by compacting the powders with the cyclic-pressing technique and then sintering and rolling the pressed bar into strip. (auth)

21968

THE COMPACTING OF GRAPHITE AND GRAPHITE/URANIUM/THORIUM MIXTURES. D. T. Livey, I. Denton, N. Brett, and J. Williams (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Powder Met. No. 5, 130-48(1960).

Fine artificial graphite powders can be cold compacted to give bodies of high density (~88% of theoretical), low permeability ($B_0 \sim 10^{-14}$ cm^2), and reasonable strength. Such powders, after vacuum annealing, will not compact. Die-compacted powder has strongly anisotropic properties owing to a high degree of preferred orientation within the compact; this effect is less marked in hydrostatically compacted powder. Minor dimensional changes occur when compacts are annealed at 600 to 1000°C. The preparation of fuels by incorporation of fissile and fertile materials into graphite powder and cold compacting is described. (auth)

21969

GROWTH OF CHROMIUM COATINGS FROM LIQUID METALLIC SOLUTIONS. S. T. Wlodek and John Wulff (Massachusetts Inst. of Tech., Cambridge). Trans. Met. Soc. AIME 218, 716-22(1960) Aug.

Dense, adherent, and ductile coatings of chromium can be applied to molybdenum by selectively freezing out the chromium solute from a supersaturated copper- or tin-rich liquid alloy. The successful exploitation of this technique depends on the control of variables common to any freezing process. Under the most favorable combination of supersaturation, nucleation, and mass-transfer, coatings as thick as 0.004 in. can be obtained. (auth)

21970

FABRICATION OF THULIUM FOIL. H. H. Klepfer and M. E. Snyder (General Electric Co., Pleasanton, Calif.). Trans. Met. Soc. AIME 218, 765(1960) Aug.

Thulium foil fabrication techniques were developed on one ingot weighing about 220 g. Copper-jacketed wafers from the ingot were forged at 1450°F. Hot rolling at 1450°F. was accomplished without edge cracking, and after reduction of thickness from 0.250 to 0.100 in. the copper jacket was removed. The oxide coat formed during hot rolling in air was removed by sand blasting and pickling. After forging to 0.250 in., vacuum annealing and cold rolling were found to be a satisfactory alternate to hot rolling in copper jackets. (M.C.G.)

21971

MELTING OF URANIUM IN VACUUM. Y. Ortel and

H. Ollier (Centre d'Etudes Nucléaires, Saclay, France). p.545-52 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In French)

The melting and pouring of U in vacuum are discussed, and the apparatus used and its operation are described. The foundry unit which acts as a feed inductor at average frequency and is placed around the outside of the fusion chamber is also described along with auxiliaries such as pumps, supply unit and couplings, and measurement gear for electric, thermal, and vacuum systems. The principle and use of three devices to improve the efficiency of the foundry unit is described; these are a flap valve, a double casting arrangement, and a membrane-rupture release mechanism for the melt. (T.R.H.)

21972

PRODUCTION OF SHEET MATERIAL. Alan Blainey (to United Kingdom Atomic Energy Authority). British Patent 838,091. June 22, 1960.

A process is presented for the production of sheets, including shaped plates and blanks, by hot or cold pressing of particulate material, powdered metals, or their oxides. (W.L.H.)

21973

IMPROVEMENTS IN WELDING REACTIVE METALS AND ALLOYS. Cyril Albert Terry (to Imperial Chemical Industries, Ltd.). British Patent 838,109. June 22, 1960.

A method and apparatus are reported for fusion welding Ti, Zr, and their alloys. The method consists of enclosing the section to be welded in an air-tight chamber, evacuating the chamber, filling the chamber with inert gas, and welding. (W.L.H.)

21974

IMPROVEMENTS IN OR RELATING TO PROCESSES FOR THE PRODUCTION OF GRAPHITE BODIES. (to Siemens-Planiawerke AG für Kohlefabrikate). British Patent 838,743. June 22, 1960.

A process is described for the production of graphite shapes by graphitizing bodies consisting of pitch coke with pitch as a binder. (W.L.H.)

21975

METHOD OF PREPARING A FUEL ELEMENT. (to United States Atomic Energy Commission). British Patent 841,608. July 20, 1960.

A method of simultaneously cladding and compacting UO_2 powder for use as a fuel element is presented. The method consists of placing the ceramic powder in a metallic capsule and reducing the diameter of the capsule to rotary swaging. (W.L.H.)

21976

IMPROVEMENTS IN OR RELATING TO THE MANUFACTURE OF GRAPHITE ARTEFACTS. Geoffrey Harvey Greenhalgh. (to United Kingdom Atomic Energy Authority). British Patent 841,643. July 20, 1960.

A method is presented for preparing graphite shapes by applying pressure to natural graphite powder contained in a flexible sheath through a fluid surrounding the sheath. (W.L.H.)

21977

IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF REFRACTORY METAL STRIP OR SHEETS BY ROLLING. Joseph Frederick Mills and William Henry Lewis Hooper. (to Imperial Chemical Industries Ltd.). British Patent 842,203. July 20, 1960.

A process is described for the fabrication of reactive refractory metals by rolling a compact into sheet or strip. The fabrication is accomplished by feeding the compact through a heating zone into a sealed chamber containing an inert atmosphere. In the sealed chamber the compact is rolled into the desired shape and cooled to a suitable lower temperature before emerging through seals at the exit from the chamber. (W.L.H.)

21978

IMPROVEMENTS IN OR RELATING TO METHODS OF PRODUCING MALLEABLE BODIES OF METALLIC BERYLLIUM. Harry William Dodds. (to Brush Beryllium Co.). British Patent 842,226. July 20, 1960.

A method for producing bodies of metallic beryllium is reported. The method consists of charging powdered Be into a mold and subjecting the interior of the mold and the beryllium to a preliminary heat treatment and evacuation at a temperature below sintering temperature until absorbed gas and vapor have been removed. Then combined evacuation, heat treatment, and mechanical pressure are applied to the beryllium at temperatures ranging from that at which sintering begins upward to that which produces pronounced grain growth. (W.L.H.)

21979

METHOD FOR MAKING FUEL ELEMENTS FOR NUCLEAR REACTORS. (to Deutsche Gold- und Silber-Scheideanstalt). French Patent 1,183,868. Feb. 2, 1959.

Fissile material is brought into an envelope of a refractory metal, after which both are joined together without solder.

21980

MASSES AND MOLDED BODIES COMPOSED OF SCALY GRAPHITE FOR APPLICATION IN ATOMIC TECHNOLOGY, AND METHOD FOR THEIR MANUFACTURE. (to Graphitwerk Kropfmühl Aktiengesellschaft). French Patent 1,184,648. Feb. 9, 1959.

Graphite masses and bodies, composed of very pure scaly graphite (scale size greater than 0.1 mm), in which the scales are orientated substantially parallel are reported. The bodies are manufactured from a flaky powder by various methods of compression, using pressures up to 10^4 kg/cm^2. The pores of the bodies may be filled by incorporating a binder, such as $(-CF_2-CF_2-)_n$ or pitch, in the flaky powder; using pitch the molded body is subjected to a carbonizing treatment, preferably followed by an electrothermal heat treatment to melt the binding carbon particles. Sensities up to 2.25 can be obtained. Reactor reflectors and moderators which have a stratified lattice can be built from these moldings. It is alleged that such reflectors considerably increase the neutron efficiency, whereas stratified moderators cause an anisotropic neutron moderation which favorably influences the breeding process.

21981

PRODUCT BASED ON GLASS AND METHOD FOR MAKING IT. (to Société Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey). French Patent 1,186,540. Feb. 23, 1959.

Methods are given for making spherical particles of glass containing 20 to 45% UO_2 or another fissile or fertile material. The UO_2 can be a component of the glass itself or dispersed in it.

21982

IMPROVEMENT OF NUCLEAR REACTORS. (to Société Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain, Chauny & Cirey). French Patent 1,186,541. Feb. 23, 1959.

Spherical particles of glass containing fissile or fertile material are suspended in the coolant of a nuclear reactor.

21983

FUEL ELEMENT AND METHOD OF MANUFACTURE. (to Metallwerk Plansee GmbH). French Patent 1,187,574. Mar. 2, 1959.

A body of U or U alloy is made according to powder metallurgical methods after which the interstices are filled with a light metal or alloy having a melting point at least 100°C lower than the matrix (e.g., Al, Mg–Be–Al). The impregnation step may be utilized for simultaneously applying an external coating.

21984

PRODUCTION OF URANIUM DIOXIDE MASSES. (to United Kingdom Atomic Energy Authority). French Patent 1,189,481. Mar. 23, 1959.

Uranium dioxide masses of a high apparent density (9.5 g/cm^3 or more) are obtained by cold compacting nonstoichiometric uranium dioxide having an oxygen excess preferably $UO_{2.03}$–$UO_{2.15}$, at a pressure of up to 1400 kg/cm^2, then sintering in an inert atmosphere during 0.5 to 2 hr at 1200 to 1500°C, preferably 1400°C. The nonstoichiometric oxide is obtained by heating UO_2 for some minutes in air at 300°C, or preferably by reduction of U_3O_8 with H_2 at 650°C.

21985

FUEL ELEMENT COMPOSITION AND METHOD FOR ITS MANUFACTURE. (to U. S. Atomic Energy Commission). French Patent 1,195,024. May 11, 1959.

A fuel element composition is given consisting of a solid solution of PuO_2 in UO_2, the proportion being 1 : 2 to 9 (preferably 1 : 2 to 5) for fast reactors and up to 1 : 99 for intermediate and thermal reactors. The solid solutions are made by adding NH_3 to a UO_2–Pu(IV) nitrate solution, drying the precipitate with acetone, and heating it in a H_2 atmosphere at 600 to 1200°C. The composition is powdered, compressed to 65% of its theoretical density and filled into a stainless steel tube. The tube is provided on both ends with a MgO insulator, alternately evacuated and swept with He, and finally capped.

21986

IMPROVED FUEL FOR NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). French Patent 1,195,686. May 19, 1959.

A nuclear fuel, consisting of carbon impregnated with fissile material, is made by passing a mixture of a liquid hydrocarbon and a solution or suspension of fissile material in a solvent (e.g., $UO_2(NO_3)_2$ in TBP) over a carbon rod which is electrically heated to such a temperature that carbonization takes place at its surface. A uranium-impregnated carbon layer is thus formed on the rod. By varying the composition of the liquid, the composition of the deposit may be altered; it is thus possible to make an outer layer of pure carbon. The composition is finally graphitized.

21987

ASSEMBLY OF FUEL ELEMENTS IN A NUCLEAR REACTOR. (to Westinghouse Electric Corp.). French Patent 1,198,509. June 15, 1959.

A fuel element assembly for water-cooled reactors is formed by soldering together a lattice consisting of thin fuel rods and short tubular spacers. One or more of these assemblies is vertically mounted in the reactor by means of a limited number of supporting and suspensory rods. This arrangement reduces the amount of constructional material needed for fuel element erection, thus permitting the use of stainless steel, facilitating coolant circulation, enabling the application of long fuel rods without danger of flection, and giving a more compact core structure.

21988

METHOD FOR MANUFACTURING A NUCLEAR REACTOR FUEL ELEMENT. (to U. S. Atomic Energy Commission). French Patent 1,198,569. June 15, 1959.

A ceramic fuel for boiling water reactors is reported consisting of UO_2 + ThO_2, prepared by intimately mixing finely divided ThO_2 and U_3O_8 or UO_3, compacting to the desired form, and sintering in air at 1450 to 2000°C. A preferred method is mixing 6.59% U_3O_8 and 93.41% ThO_2 (particle size 0.044 mm), compacting under 980 kg/cm^2, and sintering at 1750°C.

21989

METHOD FOR THE MANUFACTURE OF FUEL ELEMENTS. (to U. K. Atomic Energy Authority). German Patent DAS 1 064 651. Apr. 23, 1958. Kerntechnik 2, 262(1960) July-Aug. (In German)

The production of reactor fuel elements consisting of carbon produced from carbonized liquid hydrocarbons saturated or impregnated with fissionable materials is described. The impregnation is kept under rigid control so that the fissionable material is distributed evenly over the entire fuel element. A device used for the impregnation and carbonization of the liquid is sketched. (J.S.R.)

21990

APPARATUS FOR ARC WELDING. J. W. Lingafelter (to U. S. Atomic Energy Commission). U. S. Patent 2,931,889. Apr. 5, 1960.

An apparatus is described in which a welding arc created between an annular electrode and a workpiece moves under the influence of an electromagnetic field about the electrode in a closed or annular path. This mode of welding is specially suited to the enclosing of nuclear-fuel slugs in a protective casing. For example, a uranium slug is placed in an aluminum can, and an aluminum closure is welded to the open end of the can along a closed or annular path conforming to the periphery of the end closure.

21991

METHOD AND ALLOY FOR BONDING TO ZIRCONIUM. F. D. McCuaig and R. D. Misch (to U. S. Atomic Energy Commission). U. S. Patent 2,932,887. Apr. 19, 1960.

A brazing alloy can be used for bonding zirconium and its alloys to other metals, ceramics, and cermets, and consists of 6 to 9 wt.% Ni, 6 to 9 wt.% Cr, Mo, or W, 0 to 7.5 wt.% Fe, and the balance Zr.

21992

PROCESS OF ELECTROPLATING METALS WITH ALUMINUM. W. C. Schickner (to U. S. Atomic Energy Commission). U. S. Patent 2,934,478. Apr. 26, 1960.

A process of electroplating aluminum on metals from a nonaqueous bath and a novel method of pretreating or conditioning the metal prior to electrodeposition of the aluminum are given. The process of this invention, as applied by way of example to the plating of uranium, comprises the steps of plating the uranium with the barrier metal, immersing the barrier-coated uranium in fatty acid, and electrolyzing a water-free diethyl ether solution of aluminum chloride and lithium hydride while making the uranium the cathode until an aluminum deposit of the desired

thickness has been formed. According to another preferred embodiment the barrier-coated uranium is immersed in an isopropyl alcohol solution of sterato chromic chloride prior to the fatty acid treatment of this invention.

21993

NUCLEAR REACTOR FUEL ELEMENT AND METHOD OF MANUFACTURE. H. Brooks (to U. S. Atomic Energy Commission). U. S. Patent 2,934,482. Apr. 26, 1960.

A description is given for a fuel element comprising a body of uranium metal or an uranium compound dispersed in a matrix material made from magnesium, calcium, or barium and a stainless steel jacket enclosing the body.

21994

PROCESS OF MAKING FUEL ELEMENTS FOR NEUTRONIC REACTORS AND ARTICLES PRODUCED THEREBY. W. A. Bostrom and R. B. Roof, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,934,483. Apr. 26, 1960.

The novel fuel element is prepared by surrounding a core of U_3Si with a barrier of various specified alloys or metals, placing a jacket of zirconium around the barrier, and integrally bonding the assembly.

21995

APPARATUS AND METHOD FOR ARC WELDING. R. A. Noland and C. C. Stone (to U. S. Atomic Energy Commission). U. S. Patent 2,936,363. May 10, 1960.

An apparatus and method are given for forming a welding arc which is rotated by a magnetic field very rapidly about an annular electrode so that a weld is produced simultaneously over all points of an annular or closed path. This invention inhibits outgassing from the jacket of a fuel slug which is being welded by adjusting the pressure throughout the welding cycle to establish a balance between the gas pressure within the jacket and that of the atmosphere surrounding the jacket. Furthermore, an improved control of the magnetic field producing rotation of the welding arc is disclosed whereby this rotation is prevented from splashing about the metal being welded as the welding arc makes it molten.

21996

METHOD FOR JOINING ALUMINUM TO STAINLESS STEEL. L. C. Lemon (to U. S. Atomic Energy Commission). U. S. Patent 2,937,438. May 24, 1960.

Aluminum may be joined to stainless steel without the use of flux by tinning the aluminum with a tin solder containing 1% silver and 1% lead, tinning the stainless steel with a 50% lead 50% tin solder, and then sweating the tinned surfaces together.

21997

METHOD OF PRODUCING SHAPED BODIES FROM POWDERED METALS. A. Blainey (to U. S. Atomic Energy Commission). U. S. Patent 2,938,791. May 31, 1960.

A method is given for enclosing a body of uranium in a sheath of compacted beryllium or zirconium powder and comprises enveloping the body with uncompacted powder and pressing at a temperature above the β-γ transition point of uranium, thereby causing the uranium to flow and isotropically compress the powder.

21998

FUEL ELEMENT FABRICATION METHOD. J. N. Hix, G. E. Cooley, and J. E. Cunningham (to U. S. Atomic Energy Commission). U. S. Patent 2,938,846. May 31, 1960.

A method is given for assembling and fabricating a fuel element comprising a plurality of spaced parallel fuel plates of a bowed configuration supported by and between a pair of transverse aluminum side plates. In this method, a brazing alloy is preplaced on one surface of the aluminum side plates in the form of a cladding or layer of uniform thickness. Grooves are then cut into the side plates through the alloy layer and into the base aluminum which results in the utilization of thinner aluminum side plates since a portion of the necessary groove depth is supplied by the brazing alloy.

Properties and Structure

21999 AD-211724

Avco Corp. Avco-Everett Research Lab., Everett, Mass.
THERMAL CONDUCTIVITY OF CLEAR FUSED SILICA AT HIGH TEMPERATURES. Research Report 44. Kurt L. Wray and Thomas J. Connolly. Feb. 1959. 15p. Contract AF04(647)-278.

The thermal conductivity of clear fused silica was measured over the temperature range 300 to 2100°K in an experiment which minimized radiative energy transport. This was a steady state experiment involving the measurement of the electric current and voltage drop through a fine tungsten wire which was embedded along the axis of a cylindrical silica rod. The wire served both as a heating element and as a resistance thermometer. Thermal conductivities were calculated by graphical evaluation of the rate of change of electric power with temperature at different temperatures. The experiment yielded thermal conductivities between 2.6×10^{-3} and 2.8×10^{-3} cal/cm sec°K at room temperature, and between 4.5×10^{-3} and 5.5×10^{-3} cal/cm sec°K over the temperature range 1000 to 2100°K. (auth)

22000 ANL-5957

Argonne National Lab., Ill.
THE TRANSFORMATION TEMPERATURES OF HIGH-PURITY URANIUM. Work completed: December 31, 1957. Final Report—Metallurgy Program 3.1.1. B. Blumenthal, J. E. Baumrucker, and L. T. Lloyd. June 1960. 30p. Contract W-31-109-eng-38. OTS.

The transformation temperatures of high-purity uranium were determined by thermal analysis and dilatometry. Thermal analysis methods used include one in which the rates of heating and cooling were controlled by a differential thermocouple, and another in which repeated thermal analyses were made at independently controlled rates. The solid-state transformation temperatures and the logarithm of the heating or cooling rates at relatively low rates are related linearly. The extrapolated functions intersect at a point where the disturbing effects of hysteresis, superheating and undercooling disappear, i.e., at the equilibrium temperature. The mean transformation temperatures are 667°C for $\alpha \rightleftharpoons \beta$ and 775°C for $\beta \rightleftharpoons \gamma$. The mean temperature for melting and freezing is 1132°C. (auth)

22001 ANL-6144

Argonne National Lab., Ill.
METALLOGRAPHY OF ALUMINUM AND SOME ALUMINUM-1 w/o NICKEL ALLOYS. Raymond K. Hart and M. J. Heyduk. June 1960. 26p. Contract W-31-109-eng-38. OTS.

The microstructures of both high-purity aluminum and aluminum-1 wt. % nickel alloy surfaces were investigated by optical and electron optical techniques. Suitable surfaces were prepared by mechanical polishing and electropolishing. The prepared surfaces were etched by a variety of reagents so that their effects on the various surfaces could be observed. Several alloy surfaces were also etched

by cathodic ion bombardment. The results of surface examinations are described in detail. Particular attention was given to anomalous furrow structures which were observed in electron micrographs. (auth)

22002 ANL-6164
Argonne National Lab., Ill.
PREPARATION OF MAGNESIUM OXIDE REFRACTORIES. Final Report—Metallurgy Program 9.1.1a. R. C. Lied. July 1960. 14p. Contract W-31-109-eng-38. OTS.

Magnesium oxide was fabricated by hand tamping, mechanical vibration, dry pressing, extrusion, hot pressing, and slip casting. The dry forming was done with and without a binder. Slip casting was accomplished from both alcohol and water slurries. Magnesia ware was fired under a reducing atmosphere in an induction furnace and under an oxidizing atmosphere in an electric furnace and a gas-fired kiln. Pieces fired in the induction furnace in contact with the graphite susceptor showed deep surface pitting. The melting point of magnesium oxide was determined. Phase studies were performed on the $MgO-UO_2$ system and on the $MgO-U_3O_8$ system. (auth)

22003 ARF-2120(5 thru 8)
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
NIOBIUM PHASE DIAGRAMS. Report No. 5: Columbium–Hydrogen System. Report No. 6: Columbium–Nitrogen System. Report No. 7: Columbium–Oxygen–Nitrogen System. Report No. 8: Final Technical Report Covering the Period April 15, 1957 to April 15, 1960. Rodney P. Elliot and Steven Komjathy. May 15, 1960. 74p. Contract AT(11-1)-515. OTS.

The Nb–O equilibrium system was determined by metallographic examination of arc-cast alloys. The oxides NbO and NbO_2 melted without decomposition at 1945 and 1915°C, respectively. Eutectic reactions between Nb and NbO at 1915°C and between NbO and NbO_2 at 1810°C were found to exist. A peritectic reaction between NbO_2 and Nb_2O_5 at 1510°C was supported by experimental evidence. The maximum solid solubility of O in Nb was determined to be 0.72 wt.%. Two carbides were found to exist in the C–Nb system; hexagonal Nb_2C with a limited range of homogeneity and cubic NbC with a solubility range of 8.25 to 10.25 wt.% C. The solubility of C in Nb was determined to be 0.80 wt.% at the eutectic temperature, but this value decreased rapidly with temperature. A peritectic reaction between melt, Nb_2C, and NbC was indicated; alloys richer in C than NbC froze by eutectic reaction. H–Nb equilibrium was studied at 300 to 1500°C and O to 760 mm Hg equilibrium H_2 pressure by the Sieverts technique. A continuous solid solution was formed in the range, exhibiting bcc structure with lattice parameter increasing with increasing H content. The formation of the solid solution was exothermic. Below 300°C, the existence of a non-classical phase transformation was observed. The N–Nb equilibrium diagram was investigated in the composition range up to stoichiometric NbN and temperatures up to 2500°C. The boundary of the Nb–N solid solution was established by direct chemical analysis. Solubility was found to be 0.25 wt.% N at 1200°C and 2.5 wt.% at 2400°C. X-ray-diffraction studies revealed the existence of close-packed hexagonal Nb_2N, tetragonal NbN (Nb_4N_3), face-centered cubic NbN, and hexagonal NbN. A N–Nb phase diagram is presented which incorporates the observed equilibrium phenomena. X-ray-diffraction studies and metallographic examinations of the Nb–Nb–O system revealed equilibrium between Nb_2N and NbO and between Nb_2 and NbO_2. (See also ARF-2120-3 and ARF-2120-4.) (C.J.G.)

22004 ARF-2200-3
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
THE BORON–CARBON SYSTEM. Quarterly Report No. 1 [for] May 1, 1960–July 31, 1960. Rodney P. Elliott and R. J. Van Thyne, Aug. 5, 1960. 13p. Contract AT(11-1)-578, Project Agreement No. 4. OTS.

A definitive investigation of the boron–carbon equilibrium system is being made by x-ray-diffraction, metallographic, and thermal analytical techniques. Alloys are being produced by sintering pressed powder aggregates with subsequent arc melting. Alloys were made at two at.% intervals up to 30 at.% carbon. In the future, higher carbon compositions are to be investigated. Techniques were worked out for the metallographic preparation of the extremely hard and friable alloys. (auth)

22005 DMIC-46-H
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
DEPARTMENT OF DEFENSE TITANIUM SHEET-ROLLING PROGRAM. Status Report No. 5 [Covering the Period January 1, 1959 through December 1959]. H. R. Ogden. June 1, 1960. 78p. Contract AF18(600)-1375. (PB-151087). OTS.

A summary of the progress made on the Titanium Sheet-Rolling Program during the period from January 1, 1959, through December 1959 is presented. During this period, the production of the heat-treatable alloys was completed by one producer and is nearing completion by the other two. Three new alloys were added to the program, Ti–7Al–12Zr, Ti–8Al–1Mo–1V, and Ti–8Al–8Zr–1(Cb + Ta). These are designed to be weldable alpha alloys with high creep strength. Phase II, the development of design data, was started, with testing well under way. This work is being done on production-aged material by Lockheed Aircraft Corporation, Marietta, Georgia. Two of the seven Phase III contractors completed their programs, and evaluation is well along for the other five contractors. The two companies who conducted preliminary evaluations of three alloys chose Ti–4Al–3Mo–1V as the most promising alloy for fabrication of parts. All of the Phase III programs are scheduled for completion in 1960. (auth)

22006 DMIC-129
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
PHYSICAL PROPERTIES OF SOME NICKEL-BASE ALLOYS. M. E. Langston and C. H. Lund. May 20, 1960. 148p. Contract AF18(600)-1375. (PB-151086). OTS.

The available physical properties of 33 nickel-base alloys are tabulated along with their respective chemical compositions. A brief general description of each alloy, its uses, and available forms is also included. The 33 representative alloys are composed of nickel–copper, nickel–silicon, nickel–chromium, nickel–chromium–iron, nickel–chromium–cobalt, and Nickel–molybdenum. (auth)

22007 DMIC-Memo-59
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
METALLURGICAL CHARACTERISTICS OF A-286 ALLOY. Hiram Brown. July 26, 1960. 10p. (PB-161209). OTS.

The effect of aging on the metallurgical properties of A-286 alloy (Cr, Mg, Mo, Ni, and Ti) is discussed. (C.J.G.)

22008 GA-1281
General Atomic Div., General Dynamics Corp., San Diego, Calif.
AN EVALUATION OF NICKEL–COPPER ALLOYS FOR

USE AS GRAPHITE-CLADDING MATERIALS AT ELEVATED TEMPERATURES. J. C. Bokros. Apr. 30, 1960. 21p. Contract AT(04-3)-187. OTS.

The relative graphitization rates of nickel–copper alloys for graphite cladding were determined. The optimum composition for this application is about 70 Ni–30 Cu, the Monel composition. Alloys containing less copper graphitize when thermal-cycled in contact with graphite, and alloys containing more copper have higher coefficients of expansion and lower melting temperatures. The solution of carbon in Monel does not decrease the strength or ductility at room temperature. Carburized Monel shows elongations greater than 14% in stress-rupture tests in the 1250 to 1650°F range. (auth)

22009 GA-1361

General Atomic Div., General Dynamics Corp., San Diego, Calif.

THE NOBLE GAS PERMEABILITY CHARACTERISTICS OF GRAPHITE MATERIALS FOR USE IN GAS-COOLED REACTORS. A. B. Riedinger and L. R. Zumwalt. Apr. 1960. 24p. Project No. 32. Contract AT(04-3)-314. OTS.

Paper presented at US/UK Information Exchange Meeting on Gas-Cooled Reactors, January 21-23, 1960, at Oak Ridge National Laboratory.

The theory of gas permeation through porous materials is reviewed in brief. Experimental data are presented on the permeation of He and the fission product noble gases as a function of pressure, temperature, and time of annealing through various graphite materials of interest for use to contain or hold back volatile fission products in gas-cooled reactors. (auth)

22010 HW-63730

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN INITIAL STUDY OF THE WEAR AND GALLING OF VARIOUS FUEL ELEMENT SUPPORT MATERIALS ON AUTOCLAVED ZIRCALOY-2. J. W. Weber. Jan. 14, 1960. 7p. Contract AT(45-1)-1350. OTS.

Tests are described in which tubular fuel elements were charged into Zircaloy-2 tubes to determine if increasing the area of contact between the support and the process tube would prevent galling of the tube. The wear and galling on the process tube by other materials which might be used as bearing surfaces for the fuel elements were also studied. Test procedures, results and conclusions are included. (J.R.D.)

22011 HW-64075

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A STUDY OF THE WEAR AND GALLING OF VARIOUS FUEL ELEMENT SUPPORT MATERIALS ON AUTOCLAVED ZIRCALOY-2. Interim Report No. 2. J. W. Weber. Mar. 1, 1960. 18p. Contract AT(45-1)-1350. OTS.

Eight metals and alloys were wear-tested on autoclaved Zircaloy-2 as prospects for fuel element support-bearing surface materials. A 1.0 Cr-0.6% Mo steel showed the best results by wearing for distances up to 180 feet without scratching through the autoclaved Zircaloy-2 film. The results of these tests revealed that materials with high impact strengths and moderate hardness will give the desired wear characteristics with the autoclaved Zircaloy-2. Tests performed on Zircaloy-2 autoclaved for twelve days at 400°C and 1500 psi showed no wear improvement is gained in this application by the longer autoclave cycle. (auth)

22012 HW-64912

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

Pb–Sn ALLOY REPLACEMENTS FOR UO_2 DENSITY STANDARDS. J. A. Christensen. Apr. 25, 1960. 7p. OTS.

A correlation between the optical density of the Pb–Sn alloy and the effective UO_2 density with respect to Co^{60} gamma radiation was determined. (C.J.G.)

22013 IS-155

Ames Lab., Ames, Iowa.

SOME METALLOGRAPHIC OBSERVATIONS ON THORIUM METAL. David T. Peterson. June 1960. 11p. Contract W-7405-eng-82. OTS.

A brief discussion on the polishing and microstructure of Th is presented. (C.J.G.)

22014 KAPL-2000-9(p.B.5-B.9)

Knolls Atomic Power Lab., Schenectady, N. Y.

FATIGUE TESTS OF FUEL-CELL TUBE-STRUCTURE WELDS. S. Beitscher. 5p.

Angle sections containing weldment were machined from Zircaloy-2 fuel-cell structures and subjected to cyclic unidirectional bending stresses at room temperature. The results of the testing indicate that the fatigue life of the Zircaloy-2 angle sections at room temperature ranges from about 12,000 to 200,000 cycles at nominal stress ranges from 46,000 to 32,000 psi. From the test results and an analysis utilizing a modified Goodman diagram, the variance of the fatigue notch factor with the stress concentration factor was determined. The maximum fatigue notch factor was determined to be 3 ± 1. (auth)

22015 KAPL-2000-9(p.B.10-B.14)

Knolls Atomic Power Lab., Schenectady, N. Y.

CYCLIC STRAIN FATIGUE OF INCONEL UP TO 600°F. A. E. Dinerman. 5p.

Inconel shows increasing resistance to strain fatigue with increasing temperature up to 400°F when subjected to conditions causing failure between 10^3 and 10^6 cycles. The 600°F data fall slightly below the 400°F data. The observed fatigue behavior and tensile data of other Inconel material suggest that a strain-aging phenomenon occurs when plotted as plastic strain vs. cycles-to-failure. Inconel exhibits a straight-line behavior shown by other structural materials, but this straight-line behavior does not compare well with the tensile test results. (W.L.H.)

22016 KAPL-2000-9(p.C.1-C.4)

Knolls Atomic Power Lab., Schenectady, N. Y.

THE DIMENSIONAL INSTABILITY OF FISSIONABLE MATERIALS DURING REACTOR IRRADIATION. A. H. Willis and A. E. Bibb. 4p.

Dimensional instability was observed in both rod and plate unclad U–Zr alloys. Observations on unclad B–Zr alloy plates have shown that no similar dimensional instability occurs in these materials. It is proposed that the anisotropic precipitation point defects account for the dimensional instability of fuel materials, for the lack of this instability in B-containing alloys, and for the mechanical response of fuel and poison materials during reactor irradiation. (W.L.H.)

22017 KAPL-2000-9(p.C.5-C.20)

Knolls Atomic Power Lab., Schenectady, N. Y.

DYSPROSIUM OXIDE CERAMICS. G. L. Ploetz, A. T. Muccigrosso, et al. 16p.

The nuclear properties of dysprosium have aroused interest in the physical properties of dysprosium oxide and dysprosia-based ceramics. A sintering study was carried

out to investigate the properties of several two-component oxide systems. Alumina, CeO_2, ZrO_2, Nb_2O_5, and UO_2 were the oxides chosen for investigation. The object of the study was to determine solid solubility and/or compound formation within these five systems and to determine some of the physical properties of the compositions investigated. Data were sought on water corrosion resistance, thermal expansion, index of refraction, true density, and compound melting points. Results of the investigation are reported. (W.L.H.)

22018 LMSD-288233

Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.

GRAIN REFINEMENT IN BERYLLIUM BY ALLOYING. Technical Note [for period] July 1, 1958 through December 31, 1959. D. Crooks and H. Sumsion. Jan. 1960. 42p. Contract NOrd-17017.

This paper was originally printed under the same title in Vol. II, "Metallurgy and Chemistry," of General Research in Materials and Propulsion, January 1959-January 1960. LMSD-288140.

Previously published data on the effect of alloying upon grain refinement of cast beryllium is reviewed. Experimental procedure is described for producing beryllium alloy buttons in a vacuum-inert atmosphere arc furnace with non-consumable electrodes and water-cooled copper hearth. A method for evaluating grain refinement of the alloy buttons is described. Results of the evaluations are given. (auth)

22019 MND-E-2010

Martin Co. Nuclear Div., Baltimore.

ERDL-NPFO QUARTERLY PROGRESS REPORT NO. 12. C. Eicheldinger. July 1960. 18p.

Preparation of autoclave specimens and fabrication of the holders were completed. Tensile test and strain-deflection measurements were performed on the autoclave materials. In autoclave testing, a total of nine runs was completed during the quarter. Several methods of descaling the exposed specimens for weight loss determination are still under investigation, and no quantitative post-test evaluation was initiated. Qualitative examination showed that coupons tested in the vapor phase evidenced greater attack than those in the liquid phase. Other findings indicate that the most active environmental agent is oxygen, the agent used to adjust pH, whether phosphate or hydroxide, has no differential effect, and the magnitude of corrosion is very low (a few milligrams). Final engineering design for the corrosion loop modifications was completed. All of the major modifications were also completed, except for installation of the second independent model secondary system. In addition, final electrical wiring, hydrostatic test, and thermal insulation remain to be done. Rework of the Inconel miniature vessels and the bimetal model vessels was completed. Fabrication was complete, except for final assembly of the Inconel model vessels and the bimetal miniature vessels. Fabrication of detail parts for the Monel and nickel miniature vessels was initiated. (For preceding period see MND-E-2009.) (auth)

22020 NAA-SR-4446

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

THE REACTIONS OF WATER VAPOR WITH BERYLLIA AND BERYLLIA–ALUMINA COMPOUNDS. William A. Young. Mar. 15, 1960. 19p. Contract AT-11-1-GEN-8. OTS.

The reactions of water vapor with BeO, $BeO \cdot Al_2O_3$, and $BeO \cdot 3Al_2O_3$ were studied at 1575 to 1850°K, using a transpiration technique with water vapor at atmospheric pressure. The reaction equilibrium constants and thermodynamic results show that the addition of aluminum oxide to beryllia will not decrease the volatility of the latter sufficiently to reduce to acceptable levels the health hazards or corrosion rates associated with the use of beryllia in contact with moist gases at high temperatures. (auth)

22021 NAA-SR-Memo-1887

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

SURVEY OF MECHANICAL PROPERTIES DATA OF CERAMIC MATERIALS. R. Chang. Mar. 22, 1957. 16p. OTS.

Recently published data on the mechanical properties of ceramic materials, especially oxides, were compiled. Values for compressive strengths, relative creep rates, tensile strengths, strengths under shear by torsion, modulus of rigidity, and modulus of elasticity were determined for Al_2O_3, BeO, MgO, ZrO_2, $MgO \cdot Al_2O_3$, and $ZrO_2 \cdot SiO_2$. Values from impact testing of Al_2O_3 and MgO are given. Torsional creep of sintered Al_2O_3 was determined. Physical properties of ThO_2 were investigated. The modulus of rupture as a function of temperature was determined for pressure-sintered SiC. The effects of particle size and test temperature on the modulus of rupture of UO_2 specimens were investigated. (M.C.G.)

22022 NAA-SR-Memo-5067

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

THE DIFFUSION OF HYDROGEN THROUGH ZIRCONIUM. K. A. Sense. Mar. 10, 1960. 7p. OTS.

The diffusion rate of H in liquid Na through Zr cladding was investigated. The mole concentration of $H(C_0)$ in liquid Na at a given temperature was assumed to remain constant. The H concentration in Zr at the Zr–graphite boundary was denoted as C_g. At 250°C the values of C_g was 50% of that of C_0 in two days and in 6.5 days, C_g was 95% of C_0. At 400°C, C_g attained 50% of the value of C_0 in about 4 hours and 95% in a little less than 14 hours. (C.J.G.)

22023 NAA-SR-Memo-5199

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

U_3Si_2 FUEL EVALUATION. PART I. OXIDATION CHARACTERISTICS. N. R. Koenig. Apr. 20, 1960. 9p. OTS.

Oxidation rates for U_3Si_2 in air were determined at 100, 200, and 315°C. Both as-cast and heat-treated material was considered, with no significant difference being observed. (C.J.G.)

22024 NASA-TR-R-44

National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.

A PHENOMENOLOGICAL THEORY FOR THE TRANSIENT CREEP OF METALS AT ELEVATED TEMPERATURES. Elbridge Z. Stowell. 1959. 16p. GPO.

The theory that a metal consisting of two phases, each with its own elasticity and viscosity, will exhibit transient creep after application of a constant stress is presented. A comparison of the transient creep curves resulting from this theory with experimental data on four different metals shows that the entire family of creep curves for any one metal are given by the theory using a single set of constants appropriate to that metal. (auth)

22025 NMI-1180

Nuclear Metals, Inc., Cambridge, Mass.

GRAIN REFINEMENT OF CAST URANIUM BY HEAT TREATMENT. G. W. Powell, J. L. Klein, and D. Krashes. July 5, 1957. Decl. Mar. 16, 1960. 29p. Contract AT(30-1)-1565. OTS.

The thermal cycling, irradiation behavior, and fabrication characteristics of U are strongly dependent upon grain size; a smaller grain size yields the better properties.

hot working in the high alpha temperature range or by heat treatment; refinement by the latter method was the object of this investigation. The variables studied were time, temperature, specimen size, multiple quenching, and alpha-annealing after quenching. The results of the investigation have led to the following conclusions, within the scope of the experimental conditions. The grain size of cast U may be appreciably refined by beta-quenching. Time and temperature in the beta phase are not significant in determining the final alpha grain size. Multiple beta-quenches (two to four times) produce better grain size refinement than a single quench. Alpha-annealing after beta-quenching causes recrystallization, but does not greatly affect the grain size. Gamma-quenching is not recommended as a practical heat treatment. (auth)

22026 NMI-1237

Nuclear Metals, Inc., Concord, Mass.

RETENTION OF URANIUM BETA PHASE. A. L. Geary and V. Nerses. Aug. 5, 1960. 32p. Contract AT(30-1)-1565. OTS.

A study was carried out on the retention and metastability of the beta phase in dilute uranium base alloys. It is anticipated that, because of their greater strengths, the beta phase alloys will possess greater resistance to swelling during irradiation than either the alpha phase or gamma phase uranium base alloys. Among the alloys investigated, the U–0.3 wt.% Cr binary and the U–0.3 wt.% Cr–0.3 wt.% Nb or Mo ternary alloys exhibited the best retention and stability properties. Calculations indicate that if neutron induced phase reversion occurs, upwards of 90% beta would be retained in these alloys during irradiation at 400 to 500°C and fission rates of about 10^{14} fissions/cm^3/sec. (auth)

22027 NP-8707

New York Univ., New York. Coll. of Engineering.

DEVELOPMENT OF TOUGH, HIGH-STRENGTH, TITANIUM-BASE ALLOYS OF THE Ti–Al–V–X SYSTEM. Paul A. Farrar and Harold Margolin. Jan. 1960. 150p. Project No. DA-5B93-08-021. Contract DAI-30-069-505-ORD-(P)-1506. (WAL-401/272-4).

A program for development of titanium-base alloys with mechanical properties which meet specifications of 150,000 psi 0.1% yield strength, 10% elongation, 21% reduction in area, and 10 ft. lb. impact at –40°F is described. A second phase to develop similar alloys with 170,000 psi 0.1% yield strength, 8% elongation, 18% reduction in area, and 9 ft. lb. impact at –40°F is also reported. Alloys which appeared to meet the specified requirements are composed according to the following percentages: Alloy #34 (Ti, 5.25; Al, 5.5; V, 2; Sn, 1; Cu, 0.9; Fe), Alloy #44 (Ti, 6; Al, 6; V, 2; Sn, 3; Zr), Alloy #25 (Ti, 5.5; V, 2; Sn, 0.5; Fe, 0.25; Cu). (J.R.D.)

22028 NP-8907

Brown Univ., Providence.

COMPOSITE ALLOYS BY POWDER METALLURGY METHODS. Technical Report No. 6 (Final). D. E. Gücer and J. Gurland. June 1960. 19p. Contract Nonr-562(19)/6.

The deformation in bending of four composite, silver-base alloys was investigated on samples with, respectively, 15% tungsten, molybdenum, tungsten carbide, or nickel. It was found that the over-all plastic behavior of these particle-strengthened alloys is unaffected by the nature of the second-phase particles if the latter remain elastic. It was also attempted to produce composite bodies from non-wetting components by compacting soft metal powders together with hard particles under very high pressures to produce cold welding and subsequent sintering to improve existing bonds. Factors investigated were compacting pressure, sintering temperature, and repeated pressing-sintering cycles and their effects on density. (auth)

22029 NP-8927

General Electric Co. Research Lab., Schenectady, N. Y.

DISPERSION HARDENING. W. H. Meiklejohn and R. E. Skoda. Feb. 1959. 7p. (Memo M C-75).

An investigation of dispersion hardening in the Ag–Fe alloys revealed that the yield strength depends only on the ratio d/Λ where d is the diameter of the iron particles in the mercury and Λ is the distance between centers of the particles. Tests performed on Hg–Fe alloys at 77°K revealed that drop in yield strength of overcharged material was due to loss in coherency of the particles with the matrix. (auth)

22030 NP-8928

Horizons, Inc., Cleveland.

MECHANISM OF GROWTH AND PHYSICAL PROPERTIES OF REFRACTORY OXIDE FIBERS. Final Report. Andrew L. Cunningham. Apr. 14, 1960. 57p. Contract Nonr-2619(00).

A study was made of growth mechanisms and physical properties of Al_2O_3 involving growth from supersaturated media, such as growth from the vapor phase and growth from collodial suspensions (ZrO_2 and SiO_2 sols). Results indicate that the major growth mechanism occurs wholly in the vapor phase and involves the reaction of an Al_2O species and SiO at 1230 to 1500°K which produces Al_2O_3 and Si. A growth mechanism is postulated whereby the product Si functions as a catalyst by virtue of a back reaction with excess Al_2O to produce Al and SiO, so that the Si would continue to travel back and forth as a function of its cyclic transformation into silicon monoxide. This mechanism appeared to be the prime mechanism for nucleation. Of the growth parameters investigated, moisture content of the H atmosphere appeared to be the most critical. No fiber growth was obtained when the hydrogen dewpoint was in excess of –30°C. Excess time or temperature was productive for dense embrittled whisker growth. The introduction of metallic additives into an Al melt accelerated the fiber growth and process generally raised the optimum operating temperature. The results revealed that Al_2O_3 fiber growth was contingent upon the presence of an Si component as an intermediate. Stabilization of ZrO_2 sols was accomplished through use of Ca acetate. The Al_2O_3 fibers exhibited a maximum tensile strength of 2.96×11^6 psi. (C.J.G.)

22031 ORNL-518

Oak Ridge National Lab., Tenn.

THERMAL COEFFICIENT OF EXPANSION OF URANIUM BY MEANS OF BONDED WIRE RESISTANCE STRAIN GAGES. Martin R. Goodman. Dec. 20, 1949. Decl. Feb. 4, 1960. 54p. Contract W-7405-eng-26. OTS.

The thermal coefficient of expansion of various uranium slugs and special samples of uranium was investigated using bonded wire resistance strain gages. The coefficient of expansion of uranium at 32.5 to 60.0°C is unpredictable and may lie within the range 5.0 to 30.2×10^{-6}. This wide range is in agreement with values reported in the literature. Original structural inhomogeneities manifested by differences in coefficient of expansion found on one and the same sample are believed to exist along the uranium specimens. The strain gages used were found to have peculiar properties such as gage creep and gage zero shift which have to be differentiated from the effects due to the uranium. Methods are suggested to overcome these gage troubles. (auth)

22032 SC-4443(RR)
Clevite Research Center, Cleveland.
RESEARCH ON PIEZOELECTRIC MATERIALS AND PHENOMENA. Final Report [covering the period] February 1, 1959–January 31, 1960. Don A. Berlincourt. Mar. 11, 1960. 164p. Project No. 30180. For Sandia Corp. Contract [AT(29-1)-789]. OTS.

Measurements of mechanical strains on the lead titanate zirconate series were made during poling and the results were interpreted in terms of domain alignment. Electron micrographs were made before and after poling. Thermal expansion was measured and interpreted in terms of domain reorientation and crystal distortion. Coercive force and remanent polarization were measured over wide compositional and temperature ranges. Permittivity was measured as a function of mechanical stress. The ferroelectric properties of lithium trihydrogen selenite were investigated, and preliminary piezoelectric and elastic measurements were made. Elastic, dielectric, and piezoelectric constants of hexagonal (wurtzite) cadmium sulfide were measured. (For preceding period see SC-4306.) (auth)

22033 SEP-111
Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.
PREFERRED ORIENTATION IN ZIRCONIUM ALLOY WIRE FUEL ELEMENTS. R. W. Campbell and W. P. Chernock. Sept. 28, 1953. Decl. Feb. 16, 1960. 38p. Contract AT-30-1-GEN-366. (DCF-4287). OTS.

Texture determinations were made of the claddings and cores of wire fuel elements consisting of either 3 or 5% Zr–Sn cladding on cores of 20% U–Zr. Results are given for specimens worked at various temperatures from 600 to 900°C and subjected to reductions of area from 59 to 97%. A single $(10\bar{1}0)$ fiber texture was found in the cladding after hot swaging. Recrystallization above the swaging temperature produced a duplex $(10\bar{1}0)$ $(11\bar{2}0)$ fiber texture. A beta heat treatment appeared to randomize the texture. The texture of the α-Zr phase in the core corresponded to that predicted by assuming the conventional BCC fiber texture and applying Burger's transformation mechanism for zirconium. The orientation study of the epsilon phase in the core was somewhat questionable. Tentative results indicated a (101) fiber texture for this phase in the "as hot-swaged" condition. (auth)

22034 TID-3906
Brookhaven National Lab., Upton, N. Y.
PROPERTIES OF REFRACTORY NUCLEAR MATERIALS. Bibliography. Marjorie Comstock. Feb. 17, 1960. 18p. OTS.

A bibliography containing 294 references on the properties of carbides, nitrides, oxides, and silicides of U, Pu, and Th is presented. (C.J.G.)

22035 TID-6294
Denver. Univ. Denver Research Inst.
STUDY OF FACTORS INFLUENCING DUCTILITY OF IRON–ALUMINUM ALLOYS. Monthly Letter Report No. 2. Frank C. Perkins and Joseph F. Nachman. July 13, 1960. 3p. Contract AT(11-1)-742. OTS.

A series of isothermal heat treatments was performed on the highly ordered Al–Fe alloy, 13.6 Alfenol. Resistivity vs. time curves are presented for temperatures of 0 to 700°C. (For preceding period see TID-5730.) (C.J.G.)

22036 AEC-tr-4203
SECONDARY CARBIDES AND THE FORMATION OF THE σ-PHASE IN WELD SEAMS OF STABLE AUSTENITIC STEEL TYPE 25-20. Yu. B. Malevskii (Malevskiy) and B. I. Medovar. Translated from Avtomat. Svarka 10, No. 5, 86-94(1957). 10p. JCL or LC.

The results of electron microscope studies of the formation of the carbide and the σ-phases in weld seams of stable austenitic steel are presented. It is shown that complex secondary carbides which precipitate out in the seam during cooling after welding have an irregular shape and dimensions of the order of 300 to 800 A. Long exposure to critical temperatures (650 to 900°C) induced formation of a relatively large quantity of secondary carbides which are geometric, being shaped like cubes, prisms, and parallelepipeds. A hypothesis is proposed for the mechanism of germination of the σ-phase in pure austenitic weld seams. (auth)

22037 CEA-tr-A-689
L'INFLUENCE DES TRACES D'ÉLÉMENTS SUR LA RÉSISTANCE À L'OXYDATION DES ALLIAGES RÉFRACTAIRES. (Effects of Trace Elements on Oxidation Resistance of Refractory Alloys). H. Pfeiffer. Translated into French from Werkstoffe u. Korrosion 8, 574-9(1957). 27p.

High-temperature alloys and the various additives used to increase lifetimes, service temperatures, and oxidation resistance are discussed. Experimental investigation of the effects of additions was carried out, with various additions of Ce to a 27% Cr–5% Al–Fe alloy. The results are presented and discussed. (T.R.H.)

22038 JPRS-5006
Akademiya Nauk Ukr. S.S.R. Institut Metallokeramika i Spetsial'nykh Splavov, Kiev. THE WETTING OF REFRACTORY COMPOUNDS WITH LIQUID METALS. Valentin Nikiforovich Eremenko (Yeremenko) and Yuriy Vladimirovich Nadich (Naydich). 1958. 112p. (Translation). OTS.

The general laws of wetting are presented. Data on the surface energies of liquid metals at various temperatures are reviewed. Data on the wettability (surface energies, wetting intensity, and external wetting angle) of various refractory metallic and non-metallic surfaces by liquid metals are reviewed. A connection between the properties of oxides and their low wettability was investigated. The wetting of the (Mg,Ni)O system by liquid Sn was studied at 700 to 1100°C for Mg wt.% of 100, 80, 50, 20, 10, 5, 2, and 1. The external angle was measured as a function of time of contact and composition of the solid phase. Electric conductivity was measured as a function of composition. The wetting of the (Mg,Ni)O system by liquid AG was studied at 1000 to 1300°C for Mg wt.% of 95, 50, 10, and 2. Surface energy, external angle, and wetting intensity were measured. Similar measurements were made on wetting of the (Mg,Co)O system by liquid Sn at 700 to 900°C for Co wt.% of 10, 25, 50, 75, 90, and 95, and the (Mg,Co)O system by liquid Ni at 1500°C. Wetting measurements were made on $MgO-Cr_2O_3-Fe_3O_4$ by liquid Sn at 700 to 1100°C and the $(Al,Cr)_2O_3$ system by liquid Fe at 1550°C. The results confirmed the hypothesis that wetting of an oxide increases with an increase of the number of current carriers. The nature of the forces which act on the surface of the boundary between the metal and the oxide and which produce the energy of association was investigated. Data on the wetting of carbide and boride systems by liquid metals are reviewed. (C.J.G.)

22039 JPRS-5095
ELASTIC-PLASTIC DEFORMATION OF A WELDED CYLINDRICAL SHELL OF DIFFERENT MATERIALS. V. S. Chernina. Translated from Izvest. Akad. Nauk

S.S.S.R., Otdel. Tekh. Nauk, Mekh. i Mashinostr. No. 1, 133-40(1960). 16p. OTS.

The elastic-plastic deformation of a welded cylindrical shell composed of two different materials is examined. It is assumed that the material of the shell is ideally plastic and that hardening of the material is linear with time. (C.J.G.)

22040 TT-881

THE KNIGHT SHIFT IN ALLOYS. (Sur le déplacement de Knight Dans les Alliages). A. Blandin and E. Daniel. Translated by G. A. Gavrel (National Research Council of Canada) from Phys. and Chem. Solids 10, 126-37(1959). 27p. JCL.

The dissolution in a metal of atoms of different type or valence from those of the solvent produces oscillations of electronic density around each dissolved atom. We show that this phenomenon can explain the variations in the Knight shift of the matrix, as measured by different authors on several alloys. This explanation accounts equally well for the considerable observed broadening of the resonance lines. In agreement with experiment we find that at low concentrations the relative variation of the Knight shift is proportional to the concentration of dissolved atoms, whereas the broadening of the lines increases as the square of the concentration. The same theory accounts for analogous effects observed in liquid alloys of alkali metals. Finally, we study the influence of transition metal impurities. (auth)

22041

THE CRYSTAL STRUCTURE OF THE R PHASE, Mo-Co-Cr. Yukitomo Komura, William G. Sly, and David P. Shoemaker (Massachusetts Inst. of Tech., Cambridge). Acta Cryst. 13, 575-85(1960) Aug. (In English)

The crystal structure of the R phase in the Mo-Co-Cr system, with atom ratio 30.4-51.3-18.3, was determined by single-crystal x-ray-diffraction analysis. The crystal has space group $C_{3i}^{5}-R\bar{3}$, with 53 atoms per rhombohedral cell. The rhombohedral lattice constants are $a_0 = 9.011$ A, $\alpha = 74° 27.5'$, hexagonal lattice constants $a_0 = 10.903$, $c_0 = 19.342$ A. The structure is closely related to those of other transition-group phases such as the σ phase (Fe-Cr and many other systems), P phase (Mo-Ni-Cr and Mo-Ni-Fe), χ phase (α-Mn, Mo-Fe-Cr), and μ phase (Mo-Co and other systems). The R phase field lies directly between the σ and μ phase fields on the Mo-Co-Cr ternary phase diagram. The R phase exhibits 12-fold (icosahedral), 14-fold, 15-fold, and 16-fold atomic coordination, which are the coordinations shown in various combinations by the other phases mentioned. Like the others (except χ), the R phase has exclusively tetrahedral interstices. As with the P and σ phases, but to a somewhat lesser degree, interatomic distances in the R phase agree with sums of characteristic radii, which are different for five- and six-coordinated ligands for each type of coordination. As in the case of the P phase, the molybdenum content of the atomic sites increases with coordination from approximately zero for coordination 12 to approximately 100% for coordination 16. (auth)

22042

X-RAY INCOHERENT SCATTERING FUNCTIONS FOR NON-SPHERICAL CHARGE DISTRIBUTIONS. II. Ti^{+}, V^{+2}, Mn^{+2}, Mn AND Fe. A. J. Freeman (Ordnance Materials Research Office, Watertown, Mass. and Massachusetts Inst. of Tech., Cambridge). Acta Cryst. 13, 618-23 (1960) Aug. (In English)

Compton incoherent scattering functions were calculated for the transition elements, Ti^{+}, V^{3+}, Mn^{2+}, Mn^{+}, Mn, and Fe using available Hartree-Fock free atom wave functions. The methods reported earlier for including the effects of nonspherical charge distributions on the scattering function were employed in these calculations as well. In agreement with previous results, large differences are found from the values of James & Brindley, due mainly to the inclusion of all the exchange terms in the Waller-Hartree theory. (auth)

22043

SOME NEW INTERMETALLIC COMPOUNDS OF BERYLLIUM. R. M. Paine and J. A. Carrabine (Brush Beryllium Co., Cleveland). Acta Cryst. 13, 680-1(1960) Aug. (In English)

Two new classes of Be intermetallic compounds, M_3Be and MBe_{20}, were found in addition to compounds found in the M_2Be_{17} and MBe_{13} classes. The lattice parameters were calculated from low Bragg angle x-ray-powder-diffraction data. (1) Mo_3Be was found. (2) Hf-Be, Nb-Be, Ti-Be, Ta-Be, and Zr-Be systems were found to contain M_2Be_{17}, but not so for the Cr-Be, Mo-Be, Re-Be, V-Be, and W-Be systems. (3) $LaBe_{13}$ was found. (4) MBe_{20} was found in the Mo-Be, Re-Be, and W-Be systems. (D.L.C.)

22044

THERMODYNAMICS OF FORMATION OF COPPER-MAGNESIUM AND NICKEL-MAGNESIUM COMPOUNDS FROM VAPOR PRESSURE MEASUREMENTS. J. F. Smith and J. L. Christian (Iowa State Coll., Ames). Acta. Met. 8, 249-55(1960) Apr.

The magnesium vapor pressures over copper-magnesium and nickel-magnesium alloys were measured by the Knudsen effusion method in the temperature range, 400 to 1100°K. The free energies, enthalpies and entropies of formation of Mg_2Cu, $MgCu_2$, Mg_2Ni, and $MgNi_2$ were computed from the vapor pressure data. The results indicate that the bond strengths in the nickel-magnesium compounds are appreciably greater than in the corresponding copper-magnesium compounds. (auth)

22045

INTERMETALLIC PHASES IN THE ALUMINIUM-MANGANESE BINARY SYSTEM. M. A. Taylor (Cavendish Lab., Cambridge, Eng.). Acta Met. 8, 256-62(1960) Apr.

The region of the aluminum-manganese phase diagram from 33 to 45 wt.% manganese was investigated by means of x-ray analysis, density measurements, and microsections. Two previously unknown intermetallic compounds were isolated, and a third known phase shown to be stable only at high temperatures. Crystallographic and chemical studies of the various phases are described, and corrections to the published phase diagram are suggested. (auth)

22046

INTERNAL FRICTION IN URANIUM. A. I. Dashkovskiĭ, A. I. Evstyukhin, E. M. Savitskiĭ, and D. M. Skorov. Atomnaya Energ. 9, 27-32(1960) July. (In Russian)

The internal friction and shift in uranium are analyzed as functions of temperature. Internal friction in α uranium depends on thermal treatment and is reduced after annealing in β and γ phases. In polymorphous transformations the internal friction isothermally varies its magnitude. The $\alpha \rightarrow \beta$ and $\gamma \rightarrow \beta$ transformations are followed by reduced internal friction and $\beta \rightarrow \gamma$ and $\beta \rightarrow \alpha$ by increased internal friction. Each polymorphous uranium modification at various temperatures posesses an inherent magnitude of internal friction. (tr-auth)

22047

PHASE DIAGRAM FOR THE Zr-Be SYSTEM. V. S.

Emel'yanov, Yu. G. Godin, A. I. Evstyukhin, and A. A. Rusakov. Atomnaya Energ. 9, 33-8(1960) July. (In Russian)

Metallographic, thermal, and x-ray methods were used in qualitative phase analyses of beryllium–zirconium systems. Hardness measurements were taken, and the constitution diagram was plotted. The studies revealed four intermediate phases: $ZrBe_2$, $ZrBe_6$, $ZrBe_9$, and $ZrBe_{13}$. The first three form by peritectic reactions at 1235, 1475, and 1555°C, respectively; the last melts with an open maximum at 1645°C. A eutectic forms at 965°C and 5 wt.% Be between $ZrBe_2$ and zirconium. Additions of beryllium to zirconium reduce the temperature of $\alpha \rightarrow \beta$ transformations and form eutectoids at 800°. Beryllium solubility in α zirconium is less than 0.1 wt.% and in β zirconium less than 0.3 wt.%. Zirconium solubility in beryllium does not exceed 0.3 wt.%. (tr-auth)

22048

THERMIONIC CONVERSION OF HEAT ENERGY INTO ELECTRICAL ENERGY USING THORIUM CARBIDE. N. D. Morgulis and Yu. P. Korchevoi. Atomnaya Energ. 9, 49-51(1960) July. (In Russian)

ThC_2 is capable of relatively large emission at the mean temperature $T \simeq 2000°K$, yields a considerable number of electrons, permits uniform thermal ionization of cesium vapor along the cathode surface with neutralized space charge, and produces considerable electromotive force. Parameters for ThC_2, determined by electron and ion emissions as functions of temperature, were plotted as well as the short circuit current and electromotive force dependence on cesium vapor pressures at T = 2000°K and electromotive force dependence on cathode temperature T at t equal to 20 and 250°C. The conversion characteristics at t = 250°C and T = 21000°K and volt-amp curves are illustrated, and data at various T and t are tabulated. (R.V.J.)

22049

THE STUDY OF $BeO-Sm_2O_3$ AND $BeO-Gd_2O_3$ SYSTEMS. S. G. Tresvyatskiĭ, V. I. Kushakovskiĭ, and V. S. Belevantsev. Atomnaya Energ. 9, 54-5(1960) July. (In Russian)

Systems $BeO-Sm_2O_3$ and $BeO-Gd_2O_3$ containing 99.5 to 99.9% of the basic component were studied, and the constitution diagrams were plotted at 1300 to 2500°C. The eutectic melting temperatures were as low as for $BeO-La_2O_3$. (R.V.J.)

22050

MELTING POINT, TRANSITION POINTS AND DENSITY OF METALLIC URANIUM. Tadashi Kuroda and Tadashi Suzuki. Denki Shikensho Ihô 22, 509-12(1958).

Uranium ingots are made with a high frequency induction vacuum furnace. The melting point, transition points, and density of metallic uranium were determined. The results obtained are as follows: 1. The melting point measured by thermal analysis is 1 134°C, which is nearly identical with the datum of Dahl and Cleaves; 2. Transition points measured by thermal analysis are 672°C ($\alpha \rightarrow \beta$), 657°C ($\beta \rightarrow \alpha$), 774°C ($\beta \rightarrow \gamma$), and 754°C ($\gamma \rightarrow \beta$); and 3. The density of cast metallic uranium measured by buoyancy in water is 18.95 + 0.00 g/cc. (auth)

22051

STATISTICAL THERMODYNAMIC CALCULATION OF THE ADSORPTION EQUILIBRIUM OF ARGON ON GRAPHITE. A. V. Kiselev and D. P. Poshkus (Inst. of Physical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 132, 876-9(1960) June 1. (In Russian)

Approximation calculations were made of the chemical potential $\Delta\mu$ of argon absorption on graphite surfaces with small surface saturation Θ. Correlations of theoretical and experimental curves of the $\Delta\mu$ relation to show that statistical methods, based on theoretical calculations of the adsorption energy, offer satisfactory approximations of the chemical potential variations during argon's transition from the gas phase to the adsorbed state on a weakly saturated graphite surface. (R.V.J.)

22052

THE INFLUENCE OF THE TIME FACTOR ON THE COMPOSITION-HEAT RESISTANCE DIAGRAM OF FIVE-COMPONENT Ni–Cr–W–Ti–Al ALLOYS. I. I. Kornilov, L. I. Pryakhina, and O. V. Ozhimkova (Barkov Inst. of Metallurgy, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 132, 1086-9(1960) June 11. (In Russian)

The effect of composition and transformation time on the heat resistance of alloys was investigated by testing the creep of Ni–Cr–W–Ti–Al alloys (with contents of Al and Ni from 0 to 7.9% and constant Cr, W, and Ti) at 1150°C for 7 hours in air. Tests were also made at 900°C with an initial loading of 6 kg/mm^2 for 10,000 and more hours, and constitution diagrams were plotted. The maximum heat resistance was found with alloys having 4.5 to 5.5% Al. The heat resistance maxima on isothermal constitution diagrams (composition-heat resistance) show variations with temperature as well as with time. (R.V.J.)

22053

CHANGE IN THE WORK FUNCTION OF MOLYBDENUM BY THE APPLICATION OF THIN LAYERS OF SODIUM AND CESIUM. V. N. Lepeshinskaya and V. N. Belogurov (Kalinin Polytechnic Inst., Leningrad). Fiz. Tverdogo Tela 1, 1806-12(1959) Dec. (In Russian)

Following previous work on the effect of thin layers on the work function φ of the metal, the behavior of alkali metals, which have ionization potentials $V_i < \varphi$ was investigated. The work function φ was measured as a function of Na and Cs monatomic layers. The alkali metals were applied to the target using an ion beam in a vacuum chamber at a pressure less than 10^{-9} mm of Hg. The Mo target then was turned to an electron beam in the same apparatus, employing magnets, to measure φ. For Na, the value of this function starts at 4.2 ev for pure Mo, rising to about 4.4 ev for 0.6 monolayer, then dropping to 2.8 ev, the value of φ for pure Na, at about 2.2 monolayers. For Cs, φ drops rapidly to a minimum of about 1.7 ev at 0.7 monolayer, then rises slowly to 1.9 ev, the value of the work function of pure Cs, at about 1.5 monolayers. (TTT)

22054

SOLID SOLUTIONS OF NIOBATES AND TANTALATES OF TRANSITION METALS ON A BASE OF $BaTiO_3$. E. V. Sinyakov and E. A. Stafiĭchuk (Dnepropetrovsk State Inst.). Fiz. Tverdogo Tela 2, 73-9(1960) Jan. (In Russian)

Meta- and pyroniobates and tantalates of manganese, cobalt, and nickel were synthesized and their electrical properties investigated. It was shown that these substances are not ferroelectrics between −195° and +195°C. Investigation of solid solutions of meta- and pyroniobates and tantalates of Mn, Ni, and Co on a base of $BaTiO_3$ led to the discovery that solid solutions of pyroniobates and tantalates possess ferroelectric properties. However, with the addition in $BaTiO_3$ of more than 1% of metaniobates or tantalates the ferroelectric properties of the system disappear. (TTT)

22055

METALLIC URANIUM. PHYSICAL AND CHEMICAL PROPERTIES, AND HEAT TREATMENTS. Felice de Carli (Università, Rome). Ing. nucleare 3, 59-70(1960) Mar.–Apr. (In Italian)

Such uranium as is employed in nuclear reactors should possess the highest possible degree of purity, as certain impurities that it may contain provide an extensive capture cross section for neutrons; not only this, such impurities exert their influence on the physical and mechanical properties of the metal itself. On the other hand, the close chemical affinity of uranium with oxygen, nitrogen, hydrogen, the majority of metals, and other numerous elements, makes its purification extremely difficult, especially beyond certain limits. After recalling some of the physical properties of uranium, its main mechanical properties, which are closely bound up with its behavior in nuclear reactors are discussed. Such structural deviations and modifications in the properties of uranium as are caused by heat treatment cycles and by the irradiation to which it is subjected in reactors were examined, in the light of the latest experimental research. (auth)

22056

INTERMITTENT DEFORMATION IN Ni–Cr ALLOYS. L. E. Popov and N. A. Aleksandrov (Siberian Inst. of Physics and Tech., Kuibyshev Tomsk Univ.). Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz. No. 1, 16-22(1960). (In Russian)

Intermittent deformations in Ni–Cr alloys (16.6 wt.% Cr) and relaxation following the deformation were studied at 20 to 650°C. The relationship between relaxation and the type of deformation is determined, and the mechanism of intermittent deformation is analyzed. (R.V.J.)

22057

EFFECTS OF DISPERSION INCLUSION OF $CuAl_2$ ON THE BEHAVIOR OF DURALUMIN IN DEFORMATION AT VARIOUS TEMPERATURES. K. V. Savitskiĭ, M. P. Zagrebennikova, and V. F. Rebenok (Siberian Inst. of Physics and Tech., Kuibyshev Tomsk State Univ., USSR). Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz. No. 1, 168-70(1960). (In Russian)

The behavior of Duralumin with $CuAl_2$ dispersions of r = 0.8, 1.1, 1.5, and 2.2 μ at compression temperatures of $-80 \rightarrow 20 \rightarrow 155$°C, $20 \rightarrow -80 \rightarrow 155$°C, $155 \rightarrow 20 \rightarrow -80$°C, and $20 \rightarrow 155 \rightarrow -80$°C was investigated. (R.V.J.)

22058

SELF-DIFFUSION OF OXYGEN IN SINGLE CRYSTAL AND POLYCRYSTALLINE ALUMINUM OXIDE. Y. Oishi and W. D. Kingery (Massachusetts Inst. of Tech., Cambridge). J. Chem. Phys. 33, 480-6(1960) Aug.

The self-diffusion coefficient of oxygen was determined as a function of temperature in single-crystal and polycrystalline aluminum oxide at temperatures up to 1780°C. The rate of exchange between a gas phase and solid particles was measured, utilizing the stable isotope, O^{18}. In single crystals of aluminum oxide intrinsic diffusion occurs in a high-temperature region, depending on temperature as $D = 1.9 \times 10^3 \exp(-152{,}000/RT)$. At temperatures below about 1600°C variable results were obtained depending on impurity content and previous heat treatment. For one set of samples experimental results could be represented as $D = 6.3 \times 10^{-8} \exp(-57{,}600/RT)$. The diffusion coefficient of oxygen in polycrystalline samples is about two orders of magnitude larger than that found for the single crystals, and has a somewhat smaller activation energy. With the polycrystalline oxide, variable results were also observed at lower temperatures. (auth)

22059

IMPROVEMENT OF THE AGE-HARDENING PROPERTIES OF MAGNESIUM-RARE-EARTH ALLOYS BY ADDITION OF SILVER. R. J. M. Payne and N. Bailey (J. Stone and Co. (Charlton), Ltd., London). J. Inst. Metals 88, 417-27 (1960) June.

With the object of developing alloys of improved proof stress, the properties of cast and wrought magnesium alloys containing rare-earth metals as the principal hardening agent were studied in the solution-treated and age-hardened condition. It is shown that the response of magnesium-rare-earth alloys to age-hardening is markedly improved by the addition of 2 to 3% silver. Mechanical properties depend on the particular rare-earth mixture used and improve in the order: mischmetall, mischmetall + thorium, neodymium (i.e. a mixture of the didymium type containing a greater proportion of neodymium and a smaller proportion of less favorable rare-earth metals than does didymium). Zirconium is an indispensable constituent of cast and wrought alloys. The work indicates the suitability of two magnesium–silver–neodymium–zirconium alloys for castings: these alloys, now known as "MSR-A" and "MSR-B," show proof stresses up to 13 tons/in.^{2} The results with wrought alloys were very variable and further research is required; in some instances, proof stresses reached 23 tons/in.^{2}, a level hitherto achieved only in material with retained cold work. The improvement in properties, brought about by the addition of silver appears to be specific to that element, and this fact is briefly discussed. (auth)

22060

THE MECHANICAL PROPERTIES OF ALUMINIUM–LITHIUM ALLOYS. W. R. D. Jones and P. P. Das (University Coll., Cardiff, Eng.). J. Inst. Metals 88, 435-43 (1960) June.

The mechanical properties of aluminum–lithium alloys made from high-purity materials were determined. The best combination of properties in the binary system is given by alloys with a lithium content of ~2 to 2.5%, after solution-treatment at 580°C and aging at 130°C. The alloys are capable of age-hardening; the strength is increased, but the ductility is decreased, and this has restricted their use. A third metal (zinc, magnesium, tin, or copper) was added to the 2% lithium alloy in an attempt not only to increase its strength without sacrificing too much ductility, but also to increase the proof stress so that high ductility values may not be of primary importance. Preliminary tests showed that additions of zinc and of tin did not result in any substantial improvement. Additions of magnesium and of copper are beneficial after certain treatments; ~1% magnesium or copper produces sheets which, in the hot-rolled, solution-treated, and aged condition, have a proof stress, tensile strength, and elongation of 11 tons/in.^{2}, 17 tons/in.^{2}, and 14%, respectively, thus giving a value of ~7 for the strength: weight ratio. Higher strengths can be attained, but only at the expense of ductility; e.g. when the magnesium content was increased to ~1.75%, sheets cold rolled and subsequently aged had a strength of 26 tons/in.^{2} with an elongation of only 6.5%, and with ~2.25% copper the corresponding values were 32 and 5. Although these figures are not promising for commercial purposes, the alloys have an advantage in that the proof stress is high and that it is possible to obtain a value of ~12 for the strength: weight ratio. (auth)

22061

REACTOR SYSTEMS FOR SHIP PROPULSION. I. ENGINEERING PROBLEMS IN SHIP'S REACTORS. A. Mareske (Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Hamburg). Kerntechnik 2, 244-7(1960) July-Aug. (In German)

A survey is given of the possible reactor types for ship

propulsion, and the peculiarities which exist in ship reactors in comparison with stationary thermal power plants are pointed out. In this first part of the survey, possible reactor systems are described. (tr-auth)

22062

GALLIUM ARSENIDE FOR γ-RAY SPECTROSCOPY. W. R. Harding, C. Hilsum, M. E. Moncaster, D. C. Northrop, and O. Simpson (Services Electronics Research Lab., Baldock, Herts, Eng.). Nature 187, 405(1960) July 30.

The semiconductor gallium arsenide with resistivity at room temperature exceeding 10^6 ohm-cm was found to be an efficient counter. When a bar of this material was bombarded with gamma radiation, pulses of charge were readily observed. (M.C.G.)

22063

AN IMPROVEMENT IN THE DUCTILITY OF BERYLLIUM AT HIGH TEMPERATURES. A. Brown, F. Morrow, and A. J. Martin (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nature 187, 494-6 (1960) Aug. 6.

Brittleness in Be at temperatures above 400°C was found to be largely due to intergranular failure. Recent work indicated, however, that the temperature at which intergranular failure occurred could be raised by several hundred degrees by heat treating material of a suitable composition. Improvement in ductility was shown in an extruded ingot bar, fabricated from thermally reduced metal, after a heat which involved heating the bar at 780°C for 120 hr. This treatment, which was insufficient to promote grain growth, apparently resulted in the precipitation of certain impurities from metastable solid solution. Metallographic observations of the migration of impurities to grain boundaries in the more impure, thermally reduced metal suggested a specific impurity phase in the more impure material artificially strengthening the boundaries at high temperatures. This phase which is either absent or present to a smaller extent in the purer material appeared to migrate preferentially to the grain boundary region during heat treatment and thus improve ductility. (M.C.G.)

22064

AN IRON–SILICON CARBIDE. J. G. Humphreys and Walter S. Owen (Univ. of Liverpool). Nature 187, 589-90 (1960) Aug. 13.

X-ray studies were conducted on the microconstituents of the C–Fe–Si system reported by Marles, Hurst & Riley, and Owen & Street (X-constituent) to be an iron carbide containing silicon. The results indicate that all three carbides have identical crystal structures with hexagonal unit cells: a = 11.7 A, c = 10.8 A, and c/a = 0.925. Chemical analyses gave an approximate composition of 9% Si and 6.5% C, suggesting the formula $Fe_{10}Si_2C_3$. The x-ray data are not in agreement with those reported by Harry et al. for non-cementite carbides in low-carbon silicon steels. (D.L.C.)

22065

SOME STRUCTURAL RESULTS ON METALLIC PHASES. [PART] V. K. Schubert, S. Bhan, W. Burkhardt, R. Gohle, H. G. Meissner, M. Pötzschke, and E. Stolz (Max-Planck Inst. für Metallforschung, Stuttgart). Naturwissenschaften 47, 303(1960). (In German)

Results on the crystal structures in the metallic systems Zr–Pd, Zr–Al, Mo–Al, Mn–Al, Fe–Ga, Pt–Ga, Rh–Si, Ir–Si, Pt–Ge, Pt–Si, and Pd–As are tabulated. (J.S.R.)

22066

MAGNETIC SUSCEPTIBILITY, HEAT CAPACITY AND THIRD-LAW ENTROPY OF $MgNi_2$. J. S. Wollam and W. E. Wallace (Univ. of Pittsburgh). Phys. and Chem. Solids 13, 212-20(1960) June. (In English)

A study of the heat capacity and magnetic susceptibility of $MgNi_2$ was undertaken to evaluate the report by Voss that this compound is ferromagnetic at temperatures below 235°C. The results of the investigation reveal no evidence of ferromagnetism in this Laves phase. $MgNi_2$ is found to be a moderately strongly paramagnetic material with a susceptibility which is practically constant between 25 and 450°C. Thermomagnetic analysis shows a very slight but abrupt drop in the susceptibility at 194°C, and heat-capacity measurements reveal a very small thermal anomaly at the same temperature. The effects are thought to be associated with some type of irregularity in the lattice, such as the defect structure which occurs when a nickel atom replaces a magnesium atom in the $MgNi_2$ lattice. Third-Law entropies of $MgNi_2$ at temperatures up to 555°K are also presented. (auth)

22067

NUCLEAR MAGNETIC RESONANCE IN ALKALI ALLOY SYSTEMS, NaK AND NaRb. L. Rimai and N. Bloembergen (Harvard Univ., Cambridge, Mass.). Phys. and Chem. Solids 13, 257-70(1960) June. (In English)

The Knight shift k in liquid NaK and NaRb systems is a linear function of the relative Na concentration 1–C. The relative variation $k^{-1}(\partial k/\partial C) = 0.361$ for Na^{23} in NaK, = 0.518 for Na^{23} in NaRb, and = 0.270 for Rb^{87} in NaRb. An interpretation in terms of the scattering theory of conduction electrons is given. The line width of the Na^{23} and Rb^{87} resonances is a nonlinear function of C. It is about a factor 5 larger in the Rb-rich alloys than at the Na-rich end. This result can be explained by the electron-coupled spin exchange interaction between different nuclei. The remarkable fact that these spin–spin interactions do not average to a small value in the liquid metals necessitates the postulate of a long range character for the electron-coupled interaction. The Knight shift and line width in solid terminal solutions were also observed and compared with theory. The experiments show that nuclear magnetic resonance is particularly well suited to determine phase diagrams of alkali alloy systems. (auth)

22068

INTRODUCTION–DEFECTS IN SILICAS. G. J. Dienes (Brookhaven National Lab., Upton, N. Y.). Phys. and Chem. Solids 13, 272-8(1960) June. (In English)

As an introduction to the field of defect structure of quartz and vitreous silica the nature of bonding in silicas is reviewed briefly and a comparison is made between the crystalline and amorphous structures. It is found instructive to compare the status of the field with that of the typical ionic crystals, such as the alkali halides. Defects in silicas are then discussed more specifically under the following headings: (i) types of defects expected in silicas, (ii) production of defects by nuclear radiations and (iii) comparison of defects in crystalline and amorphous silicas on the basis of optical studies. (auth)

22069

RESISTIVITY AND KNIGHT DISPLACEMENT IN LIQUID SODIUM ALLOYS. E. Daniel (Physique des Solides, Paris). Phys. and Chem. Solids 13, 353-5(1960) June. (In French)

A model developed for dilute solid solutions of elements of different valences is applied to liquid alloys of elements of the same valence. The model gives values for the resistivity and the Knight displacement simultaneously and in good agreement with experiment for alkali metal alloys. The model does not apply when the electronegativity of the

solute differs appreciably from that of the solvent. This suggests that one should in this case consider as a whole the dissolved atom and its nearer neighbors, the electron clouds of which should be strongly perturbed. (tr-auth)

22070

HALL COEFFICIENT IN TIN–BISMUTH ALLOYS. P. A. Bender and W. F. Love (Univ. of Colorado, Boulder). Phys. Rev. 119, 506-7(1960) July 15.

The Hall coefficient in a series of tin-bismuth alloys was measured at 75°K as a function of composition. The results are compared with previous results on the band structure in these alloys They indicate that hole conduction is present though not always dominant throughout the range of alloys studied. (auth)

22071

COMPARISON OF STRUCTURES OF SURFACES PREPARED IN HIGH VACUUM BY CLEAVING AND BY ION BOMBARDMENT AND ANNEALING. D. Haneman (Brown Univ., Providence). Phys. Rev. 119, 563-6(1960) July 15.

A comparison was made for a bismuth telluride crystal of the structure of (0001) surfaces produced by cleaving in high vacuum with similar surfaces prepared by the ion-bombardment and annealing technique. The low-energy electron-diffraction patterns of the two surfaces were found to be similar and of approximately the same intensities. Only integral order beams were present. It is concluded that both methods produce essentially clean surfaces with the same atomic arrangements in the case of this crystal. (auth)

22072

THEORY OF DIAMAGNETISM OF GRAPHITE. J. W. McClure (Union Carbide Corp., Cleveland). Phys. Rev. 119, 606-13(1960) July 15.

The conduction-electron diamagnetism was calculated for the three-dimensional band structure of graphite. The magnetic energy levels are found and the susceptibility calculated by analytically carrying out the free energy sum. Agreement with experiment is found for values of the band parameters nearly equal to those which give agreement with the de Haas-van Alphen effect and other phenomena. The value of γ_0 is found to be 2.8 ± 0.1 ev. The results indicate the γ_1 is about 0.27 ev and Δ is about 0.025. The other band parameters do not have an important influence upon the value of the susceptibility. The relation to the general treatments of conduction-electron diamagnetism is also discussed. (auth)

22073

LATTICE DYNAMICS OF ALKALI HALIDE CRYSTALS. A. D. B. Woods, W. Cochran, and B. N. Brockhouse (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Phys. Rev. 119, 980-99(1960) Aug. 1.

Theoretical and experimental studies were made of the lattice dynamics of alkali halides. A theory of the lattice dynamics of ionic crystals is given based on replacement of a polarizable ion by a model in which a rigid shell of electrons (taken to have zero mass) can move with respect to the massive ionic core. The dipolar approximation then makes the model exactly equivalent to a Born-von Kármán crystal in which there are two "atoms" of differing charge at each lattice point, one of the "atoms" having zero mass. The model was specialized to the case of an alkali halide in which only one atom is polarizable, and computations of dispersion curves were carried out for NaI. The dispersion $\nu(q)$ relation of the lattice vibrations in the symmetric [001], [110], and [111] directions of NaI at 110°K were determined by the methods of neutron spectrometry. The transverse acoustic, longitudinal acoustic, and transverse optic branches were determined completely with a probable error of about 3%. The dispersion relation for the longitudinal optic (LO) branch was determined for the [001] directions with less accuracy. The agreement between the experimental results and the calculations based on the shell model, while not complete, is quite satisfactory. The neutron groups corresponding to phonons of the LO branch were anomalously energy broadened, especially for phonons of long wavelength, suggesting a remarkably short lifetime for the phonons of this branch. (auth)

22074

BONDING IN CARBIDES, SILICIDES, AND BORIDES. D. A. Robins (General Electric Co., Ltd., Wembley, Middx., Eng.). Powder Met. No. 1-2, 172-88(1958).

The hypothesis that many of the properties of the transition metals, their alloys, and their compounds can be understood in terms of a relationship between the co-ordination of the metal atoms and the number of bonding electrons per atom, is applied to the carbides, silicides, and borides of the transition metals of Groups IVa, Va, and VIa. The crystal structure and stability of the carbides can be satisfactorily explained on the basis of electron concentration, but a complete understanding of the bonding in the silicides and borides is more difficult. In the silicides the metal-silicon bonding, which is metallic in character, becomes of increasing importance as the silicon content is increased, and in the disilicides no direct metal–metal bonding remains. The ability of boron to form strong boron–boron bonds is important in the borides, and the metal–metal co-ordination would appear to be of only secondary importance. The practical significance of the principles put forward is discussed. (auth)

22075

THE HIGH-TEMPERATURE PROPERTIES OF CERAMICS AND CERMETS. E. Glenny and T. A. Taylor (National Gas Turbine Establishment, Farnborough, Hants, Eng.). Powder Met. No. 1-2, 189-226(1958).

It is recognized that, with progressive increases in the working temperature of gas turbines, metallic alloys may no longer be adequate for rotor or stator blading. The use of more refractory but more brittle materials, i.e., ceramics and ceramic–metal mixtures (cermets) was suggested. An evaluation is given of the major properties involved, viz. creep strength, fatigue strength, resistance to thermal fatigue (i.e., to repeated thermal shocks), oxidation-resistance, and impact-resistance. The materials evaluated include oxides, oxide-metal cermets, carbides, carbide-metal cermets, molybdenum disilicide, and silicon nitride. The equipment for determining the effects of alternating and steady mechanical stresses to 1200°C is described. The relative merits of the test materials are discussed. It is concluded that the resistance to thermal fatigue and to impact of the ceramics and cermets is inferior to that of metallic alloys in current use. (auth)

22076

THE FABRICATION AND PROPERTIES OF CHROMIUM–ALUMINA AND MOLYBDENUM–CHROMIUM–ALUMINA CERMETS. J. B. Huffadine, L. Longland, and N. C. Moore (Plessey Co., Ltd., Towcester, Northants, Eng.). Powder Met. No. 1-2, 235-52(1958).

After a brief review of the literature, various methods for preparing chromium–alumina and molybdenum–chromium–alumina cermets are described. The properties of such materials are discussed and an indication is given of their possible applications. (auth)

22077

THE FABRICATION AND PROPERTIES OF URANIUM OXIDE–IRON CERMETS. W. J. Wright (Atomic Energy Commission, Australia), R. B. Gibbon, and J. Williams. Powder Met. No. 1-2, 253-72(1958).

Cermets of iron–uranium dioxide, to 30 vol.-% UO_2, were rolled to rod. Although the cores rolled centrally along the length, the core was distorted in section owing to stiffening of the core relative to the sheath as the temperature dropped during rolling. The UO_2 particles were fragmented during rolling and formed as "stringers" along the direction of rolling, seriously weakening the structure transversely. By extrusion at 1200°C, cermets to 50 vol.-% UO_2 were satisfactorily fabricated. The extrusion pressure increased sharply above 35 vol.-% of ceramic and when large reductions in area were taken. The extrusion characteristics do not conform to isotropic plastic extrusion nor to a pure viscosity effect; the influence of the dispersed particles on metal flow is explained by a strong interference effect between particles and the metal during flow. The properties of the extruded rods were good; the core density was 90 to 95% of theoretical, decreasing slightly with increasing ceramic content. There were no obvious directional properties in the core, nor was the ceramic fragmented as in rolling. The characteristic "tail-end defect" of the extrusions was partly corrected by using shaped sealing plugs. (auth)

22078

TEXTURES IN BERYLLIUM RODS AND TUBES EXTRUDED FROM CONSOLIDATED POWDER. N. A. Hill and J. Williams (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Powder Met. No. 5, 116-29(1960).

The textures in beryllium rods and tubes extruded from consolidated powder were studied by x-ray diffraction techniques. The temperature of extrusion has little effect on the texture, but the extrusion reduction determines which of two main types of texture is developed in tubes. In low-reduction textures ($\leq 6:1$), the basal planes tend to concentrate parallel to the surface of the tube; in high-reduction textures ($\geq 12:1$), the basal planes still lie parallel to the extrusion direction, but tend to concentrate at angles ranging from 50–90° to the surface. A prism-plane fibre texture is present in all tubes. The deformation mechanisms possibly responsible for these textures are discussed. (auth)

22079

COLUMBIUM–OXYGEN SYSTEM. Rodney P. Elliott (Armour Research Foundation, Illinois Inst. of Tech., Chicago). Trans. Am. Soc. Metals 52, 990-1014(1960).

The niobium-oxygen equilibrium system was determined by metallographic examination of arc-cast alloys made of electron-gun-refined niobium metal and special purity niobium pentoxide. Two intermediate oxides, NbO and NbO_2, melt without decomposition at 1945 and 1915°C (3533 and 3479°F), respectively. Eutectic reactions exist between niobium and NbO at 1915°C (3479°F) and between NbO and NbO_2 at 1810°C (3290°F). Experimental evidence supports a peritectric reaction between NbO_2 and Nb_2O_5 at 1510°C (2750°F). The maximum solid solubility of oxygen in niobium metal is 0.72 weight %. (ASM-SLA Classification: M24b; Nb,O). (auth)

22080

QUANTITATIVE ADDITION AND RECOVERY OF OXYGEN ISOTOPES IN NIOBIUM (COLUMBIUM). W. F. Harris, W. M. Hickam, M. H. Loeffler, and D. H. Shaffer (Westinghouse Research Labs., Pittsburgh). Trans. Met. Soc. AIME 218, 625-8(1960) Aug.

Experiments were performed on the quantitative addition to niobium of enriched isotopes O^{18} and O^{17} at the 0.1 to 40 microgram level and their subsequent recovery. A measured quantity of molecular oxygen of known isotopic concentration was added to niobium metal by oxidation. Recovery of the enriched isotopes as carbon monoxide was accomplished by the vacuum fusion technique. Quantitative determinations of the enriched isotopes were made in standard volumes at constant temperature using accurately calibrated micromanometers and the mass spectrometer as pressure measuring instruments. (auth)

22081

THE GAMMA TO EPSILON TRANSFORMATION IN Zr 20 TO 70 WT PCT U ALLOYS. A. A. Bauer (Battelle Memorial Inst., Columbus, Ohio). Trans. Met. Soc. AIME 218, 636-44(1960) Aug.

The γ-to-ϵ transformation was studied in zirconium alloys containing 22 to 70 wt.% U. In this range of compositions the γ phase can be retained by quenching. Transformation to ϵ occurs by a nucleation-and-growth process. The diffusion of atoms to preferred lattice sites to yield a partially ordered structure apparently controls the rate of reaction. Alpha uranium and α zirconium precipitate from the supersaturated ϵ phase initially formed in alloys outside the equilibrium ϵ phase composition limits. (auth)

22082

THE SOLUBILITY OF LEAD IN LIQUID IRON. Arthur E. Lord and Norman A. Parlee (Purdue Univ., Lafayette, Ind.). Trans. Met. Soc. AIME 218, 644-6(1960) Aug.

Measurements of the solubility of lead in liquid iron were made at 1550, 1600, 1650, and 1700°C using two different methods: liquid iron-liquid lead equilibration and liquid iron-lead vapor equilibration. (auth)

22083

Co-RICH INTERMEDIATE PHASES IN THE Cb–Co SYSTEM. Shozo Saito and Paul A. Beck (Univ. of Illinois, Urbana). Trans. Met. Soc. AIME 218, 670-4(1960) Aug.

Metallographic and x-ray-diffraction study of Nb-Co alloys in the composition range of 7 to 33 at.% Nb, after annealing at 1175°C, showed that near 25 at.% Nb an $MgNi_2$-type hexagonal Laves phase exists in a narrow composition range, and that an $MgCu_2$-type cubic Laves phase occurs between approximately 27 and 32.6 at.% Nb. Lattice parameter and density measurements indicated that, in both phases, the deviations from proper Laves stoichiometry resulted from the substitution of cobalt atoms for some of the niobium atoms. The same phases occur at 1000°C, together with an additional phase of unknown structure, which appears between the hexagonal Laves phase and the cobalt-base terminal solid solutions. (auth)

22084

CONSTITUTION OF Fe C Mo ALLOYS CONTAINING 0.05-1.3 pct C AND 0.03-6.0 pct Mo. R. F. Campbell (U. S. Steel Corp., Research Center, Monroeville, Penna.) and S. H. Reynolds, L. W. Ballard, and K. G. Carroll. Trans. Met. Soc. AIME 218, 723-32(1960) Aug.

Based on metallographic and x-ray data, probable equilibrium conditions in Fe-C-Mo alloys from 1340 to 2400°F are presented for the composition range investigated. These are correlated with investigations of Takei and Kuo. Provision is made for existence of Mo_2C and $(Fe, Mo)_{23}C_6$ carbides heretofore omitted in diagrams in this composition range. These carbides and $(Fe, Mo)_6C$, in equilibrium with ferrite and austenite, restrict the austenite and austenite + ferrite fields to lower carbon contents and higher temperatures than in the Fe-C system. (auth)

22085

RELATIONSHIP BETWEEN THE Mu PHASE AND THE SIGMA PHASE IN THE Mo–Mn–Co SYSTEM. B. N. Das and Paul A. Beck (Univ. of Illinois, Urbana). Trans. Met. Soc. AIME 218, 733-7(1960) Aug.

By studying the 1175°C isothermal section of the Mo-Mn-Co system, it was established that the μ phase, and probably also the β-Mn phase, are also "electron compounds" in the sense the σ phase is. (auth)

22086

THE RARE-EARTH METALS AND THEIR USES IN INDUSTRY. E. M. Savitskiĭ. Vestnik Akad. Nauk S.S.S.R. 30, No. 6, 81-8(1960) June. (In Russian)

The rare-earth metals which constitute 0.01% of the Earth's crust, are 10 to 100 fold more common than Zn, Cu, Pb, or Sn. Being extracted from 250 commercial ores, they form the basis of a new industry in the Soviet Union. Research on their industrial application is in progress at the Baĭkov Institute of Metallurgy of the Academy. The pure metals are not quite refractory and their microhardness is strongly influenced by their O content or by other impurities. They form refractory oxides and sulfides and in view of their reaction with H, they are used as H absorbers. As it has no affinity toward U and Pu and because of its low thermal neutron capture cross section, Y is a useful component in the construction of nuclear reactors. On the other hand elements with high capture cross sections, such as Gd, Sm, Eu, and Dy have potential applications as alloying additions or as cermet components for the fabrication of control rods. The ferromagnetic Gd is also useful for the manufacture of magnets, while Pr^{147} finds application in small atomic batteries, Tm^{170} as a gamma source, LaB_6 as cathode material in electron tubes, and Y^{90} in medical uses. The elements also have great potentialities for use in metallurgy as alloying additions as they improve the chemical and mechanical properties of many alloys. (TTT)

22087

RESISTOMETRIC STUDY OF THE EFFECTS OF DEFECTS ON THE COLD-HARDENING OF ALUMINUM–ZINC ALLOYS. Werner Köster and Gernot Hofmann (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 51, 303-13(1960) June. (In German)

The change of the electrical resistance in the first stages of the age-hardening of aluminum-zinc-alloys in the concentration range 8 to 30% Zn vs. the homogenizing and aging temperatures was investigated. The quenching speed was 200°/sec. The age-hardening was accelerated with increasing homogenizing temperature up to 400°C, at higher temperatures the trend was reversed. The inversion temperature is in a first approximation independent of the aging temperature and decreases with increasing content of zinc. The experimental results are interpreted as the effect of lattice vacancies on the kinetics of the formation of zones. The dominant influence of an excess of vacancies is indicated by the presence of an inversion temperature under the conditions of the test. (auth)

22088

ELECTRON–OPTICAL STUDY OF OXIDE LAYERS ON NICKEL–CHROMIUM AND NICKEL–CHROMIUM–IRON ALLOYS. Irmtraud Pfeiffer (Vacuumschmelze A.G., Hanau, Ger.). Z. Metallk. 51, 322-6(1960) June. (In German)

The composition of oxide layers on nickel-chromium-alloys with different iron concentrations is investigated. While thin layers of 300 to 500 A thickness mainly consist of spinels, thicker layers with a thickness of 10 to 20 μm contain a considerable portion of Cr_2O_3. The origin of this different behavior may be seen in selective oxidation. (auth)

22089

THE COERCIVE FORCE OF NICKEL AND IRON–NICKEL ALLOYS IN PLASTIC DEFORMATION. Eckart Kneller and Gerd Schmelzer (Max-Planck–Institut für Metallforschung, Stuttgart). Z. Metallk. 51, 342-9(1960) June. (In German)

The coercive force of single crystals and polycrystals of nickel and cubic fcc iron-nickel alloys was measured as dependent on plastic deformation. The coercive force of the single crystals as a function of flow stress has three regions of different slope which correspond to the three regions of the work hardening curve. The effect of magnetoelastic interactions between magnetization and dislocations as well as special alloy effects on the coercive force are discussed. (auth)

22090

STRUCTURE OF HAFNIUM–TUNGSTEN SYSTEM. Horst Braun and Erwin Rudy (Metallwerk Plansee A.G., Reutte/Tirol, Ger.). Z. Metallk. 51, 360-3(1960) June. (In German)

Using arc-melted specimens, the system hafnium–tungsten has been investigated by x rays, light microscope, and determination of melting points. Characteristic are very narrow regions of solid solution at the system boundaries and an extremely hard intermetallic compound HfW_2, which forms peritectically. (auth)

22091

SIZE AND CONDITION OF PRECIPITATIONS AT LARGE-ANGLE GRAIN BOUNDARIES. Wolfgang Bernhardt and Friedrich Erdmann-Jesnitzer (Institut für Metallkunde und Materialprüfung an der Bergakademie, Freiberg/Sa., Ger.). Z. Metallk. 51, 364-7(1960) June. (In German)

An experimental study was made of precipitation at large-angle grain boundaries for the binary system Al–Cu. Study of the arrangement of precipitated Al_2Cu crystallites in the grain-contacting surface for two different thermal treatments gave information on lattice processes at large-angle grain boundaries which contain contacting grains. The size of the crystallites precipitated from supersaturated solution varies from one grain boundary to another and is strongly influenced by heat treatment. The arrangement in the grain-contacting surface apparently conforms to the geometric regularity. (tr-auth)

22092

RESEARCH ON PRECIPITATION AND HARDENING IN AN ALUMINUM–GERMANIUM ALLOY. Horst Böhm (Bergakademie, Clausthal, Ger.). Z. Metallk. 51, 409-13(1960) July. (In German)

The precipitation hardening of an aluminum alloy with 5% Ge is investigated by means of hardness—and conductivity tests, and also by microscopic—and x-ray techniques. Particularly, the dependence of the precipitation speed versus the cooling rate after the homogenizing and the pre-precipitation at higher and lower temperature are investigated and discussed. (auth)

22093

ATTACK OF METALS BY IONIC BOMBARDMENT. A. N. Vander Linden-Bauwens (Centre d'Étude de l'Énergie Nucléaire, Mol, Belg.). p.553-6 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum.

Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In French)

An etching process for preparation of metallographic samples is described. It consists of bombarding the sample with Ar ions at a certain pressure. The usefulness and quality of this cathodic etching are illustrated by electron micrographs of U, U–Nb, U–Zr, U–Si, and U–Mo. (T.R.H.)

22094

THE EFFECTS OF OXYGEN, NITROGEN, AND CARBON ON THE MECHANICAL PROPERTIES OF NICKEL AND CHROME STEELS. W. H. Scheibe (Deutsche Gold- und Silber-Scheideanstalt A. G., Hanau am Main, Ger.). p.559-61 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In German)

A study is reported of the effects of O_2, N_2, and C on notch impact sensitivity and hardness of Ni and Cr steels. High-precision analytical techniques were used to establish the direct dependence of these properties on small amounts of these elements. (T.R.H.)

22095

INTRODUCTION TO PLUTONIUM METALLURGY. W. D. Wilkinson (Argonne National Lab., Lemont, Ill.). p.1-22 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

An outline of Pu physical metallurgy and properties is given. Some of the topics discussed are: (1) Properties of Pu, e.g., density, vapor pressure, electron energy levels, negative expansion coefficients of delta and delta-prime Pu. (2) Nuclear properties of Pu, e.g., α activity of Pu^{239} and means of controlling this activity, neutron fission dose rates, criticality considerations. (3) Chemical properties of Pu, e.g., heats of formation of several Pu compounds, oxidation, aqueous corrosion, potentials of various oxidation states in solution. (4) Properties of alpha, beta, gamma, delta, delta-prime, and epsilon Pu, e.g., structure, thermal and mechanical properties, stability. (D.L.C.)

22096

SOME PRINCIPLES OF THE ALLOYING BEHAVIOR OF PLUTONIUM. J. T. Waber (Los Alamos Scientific Lab., N. Mex.). p.111-47 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

The tendency of plutonium to dissolve alloying elements in its fcc (delta) and bcc (epsilon) phases is discussed in terms of atomic radii and electronegativities. The tendency to form immiscible liquids with other elements is analyzed by Mott's extension of Hildebrand's method. These predictions are compared with the available phase diagrams for plutonium. Some consideration is given to the Brillouin zones of several plutonium allotropes. The compound-forming tendencies of plutonium are discussed in terms of Pauling's recent theory of electron transfer. (auth)

22097

PLUTONIUM–CERIUM PHASE DIAGRAM. F. H. Ellinger, C. C. Land, and E. M. Cramer (Los Alamos Scientific Lab., N. Mex.). p.149-67 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

Thermal, dilatometric, x-ray diffraction, and metallographic techniques were used in establishing the phase relationships in plutonium–cerium alloys. The phase diagram is characterized by a eutectic, extensive solid solubility of cerium in δ-plutonium and of plutonium in β-cerium (face-centered cubic), and the absence of intermediate phases. The solubility of cerium in δ-plutonium decreases from a maximum of 25 at.% at 592°C to 18 at.% at 200°C. Delta plutonium containing 5 or more at.% cerium is stable at room temperature. The solubility of plutonium in β-cerium decreases from a maximum of about 37 at.% plutonium at 592°C to 5.4 at.% at 200°C. The important isothermal reactions in the system may be described as follows (the subscripts denote the composition in at.% cerium): (1) Eutectic at 625°C, $L_{18} \rightleftharpoons Pu_{16} + \beta\text{-}Ce_{77}$. (2) Peritectoid at 592°C, $\epsilon\text{-}Pu_{12} + \beta\text{-}Ce_{63} \rightleftharpoons \delta\text{-}Pu_{25}$. (3) Inverse peritectic at 720°C, $\gamma\text{-}Ce_{\sim 10} \rightleftharpoons L_{53} + \beta\text{-}Ce_{97}$. (auth)

22098

PLUTONIUM–ZINC PHASE DIAGRAM. E. M. Cramer, F. H. Ellinger, and C. C. Land (Los Alamos Scientific Lab., N. Mex.). p.169-80 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

The binary alloys of plutonium and zinc were studied by the methods of thermal analysis, x-ray diffraction, and metallography. Four intermediate phases occur and have zinc-to-plutonium ratios of 2, 4.5, 8, and 8.5. Eutectic lowering of the melting points of the terminal phases was not detected; however, a eutectic reaction occurs between $PuZn_2$ and Pu_2Zn_9. With the exception of epsilon and delta plutonium, which will dissolve about 3 to 4 at.% zinc, respectively, mutual solid solubilities are quite restricted. (auth)

22099

A STUDY OF THE TRANSFORMATION KINETICS OF ALPHA, BETA, AND GAMMA PLUTONIUM. Ronald D. Nelson (General Electric Co., Richland, Wash.). p.215-30 of "Extractive and Physical Metallurgy of Plutonium and its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

The gamma-to-beta-alpha time-temperature-transformation (TTT) curve has the form of a double C curve. The temperature at which the maximum rate of the gamma-to-beta transformation occurred was 100°C. The temperature of the maximum rate of the gamma-to-alpha transformation was below −78°C; it was not readily determined. The gamma phase transformed directly to the alpha phase at temperatures lower than 82°C. The rate of formation of alpha directly from the gamma phase was more rapid than from the beta phase. The rate of reaction of the alpha-to-beta transformation was quite sluggish below 124°C and rapid above 135°C. The TTT curves of the formation of gamma when transformed directly from the alpha or when transformed from the beta were very nearly identical. They were similar to the alpha-to-beta TTT curve. The final grain size was significantly dependent upon the rate of formation of alpha. It appeared that the beta grain size had little influence on the final grain size. (auth)

22100

BEHAVIOR OF SOME DELTA-STABILIZED PLUTONIUM

Gschneidner, Jr. (Los Alamos Scientific Lab., N. Mex.). p.243-62 of "Extractive and Physical Metallurgy of Plutonium and Its Alloys, Including a Special Introduction and Annotated Bibliography by W. D. Wilkinson, Argonne National Laboratory." W. D. Wilkinson, ed. New York, Interscience Publishers, 1960.

Delta-phase, Pu-rich, binary alloys containing Al, Zn, In, and Ce were observed at pressures up to 11,000 atm at 24 ± 1°C. Some of these alloys transformed under compression, and their transformation pressures and volumes, densities, compressibilities, and hardnesses were determined as a function of composition. The natures of the observed high-pressure transformations are discussed and related to their respective binary alloy phase diagrams with plutonium. (auth)

22101

National Bureau of Standards, Washington, D. C.
PROPERTIES OF HIGH-TEMPERATURE CERAMICS AND CERMETS. ELASTICITY AND DENSITY AT ROOM TEMPERATURE. S. M. Lang. National Bureau of Standards Monograph 6. 1960. 47p. $0.20(GPO).

In order to provide some of the basic data necessary for the effective utilization of ceramics and cermets in various high-temperature applications, a specimen "bank" of such materials, mainly commercially fabricated, was established for the measurement of physical properties and constants. This Monograph describes: (1) the materials and some of their fabrication data, (2) bulk densities, (3) theoretical densities, and (4) the dynamic room-temperature elastic constants. Data are given for 46 sets of specimens, representing 20 different materials; these include oxides, carbides, borides, cermets, and an intermetallic compound. A statistical evaluation was used for analyzing the data. Results of the room-temperature measurements show that: (1) significant variations are common both in the specimens of one group and from group to group of specimens prepared of the same material, (2) the largest variations occur for specimens formed by hot-pressing, although average values are higher for hot-pressed specimens, and (3) measurements of the dynamic elastic constants by the sonic method are more sensitive as indicators of homogeneity and group uniformity than bulk-density measurements. (auth)

22102

MATERIALS FOR PRESSURIZED WATER REACTORS. Warren E. Berry (Battelle Memorial Inst., Columbus, Ohio). Battelle Tech. Rev. 6p.(1960) June.

An evaluation was made of materials for corrosion resistance in pressurized-water reactors. The selection of materials is generally limited to metals and alloys. Non-metallics, such as ceramics and plastics, become "water logged" or are attacked by the high-temperature water. Notable exceptions are carbon and sintered Al_2O_3. Some of the unsolved problems of corrosion which continue to be of concern to design engineers are discussed. In spite of the many corrosion problems associated with PWR, the technology has advanced to the point that this type of reactor is feasible and can be operated successfully with a minimum of malfunctions attributable to corrosion. (B.O.G.)

22103

IMPROVEMENTS IN AND RELATING TO THE PRODUCTION OF SUBSTANTIALLY PURE THORIUM AND URANIUM AND BINARY AND TERNARY ALLOYS OF THORIUM, URANIUM AND ZIRCONIUM. (to Commonwealth Scientific and Industrial Research Organization). British Patent 841,605. July 20, 1960.

A process is presented for the production of high-purity Th and U by reacting the carbide with iodine and decomposing the iodide to form the metal. The preparation of binary and ternary alloys of Th, U, and Zr by the same process is also reported. (W.L.H.)

22104

CERMET COMPOSITIONS. (to United Kingdom Atomic Energy Authority). French Patent 1,182,683. Jan. 19, 1959.

Cermet compositions, to be used as fuel in high-temperature nuclear reactors, are manufactured by cold mixing 5 to 25 wt.% Si and 95 to 75 wt.% UO_2 or U_3O_8 powder, compressing at 70 kg/cm^2, heating under this pressure to 1000°C, then further compressing and heating to 140 kg/cm^2 and 1400°C. The cermets have a better thermal shock resistance than uranium oxide (bending strength 315 to 470 kg/cm^2 instead of 78 kg/cm^2 after cooling from 400°C) and also a better oxidation resistance (rate of oxidation 21 mg/cm^2 · h instead of 55 mg/cm^2 · h at 800 to 900°C).

Radiation Effects

22105 AD-236494

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ELECTRICAL CONDUCTIVITY OF VARIOUS ALKALI HALIDES WHEN EXPOSED TO COBALT-60 GAMMA RADIATION (thesis). William Clyde Griffith. Mar. 1960. 72p.

Electrical conductivities of NaCl, KCl, KBr, KI, and LiF were measured as a function of dose rate for gamma intensities of 1×10^6 to 7×10^6 ergs/g(c)-hr. Theory predicts that the conductivity is proportional to the intensity raised to an exponent χ, where $0.5 \leq \chi \leq 1.0$. The exponents were obtained as follows: NaCl, 0.75; KCl, 0.83; KBr, 0.89; KI, 0.95; and LiF, 0.51. The ratio of the exponent, χ, to the lattice constant is shown to be the same for all alkali halides tested, i.e., $(1.32 \pm 0.05) \times 10^7$ cm^{-1}. (auth)

22106 AD-236497

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
INVESTIGATION OF THE PHYSICAL PROPERTIES OF META-LINKED POLYPHENYL ETHERS BEFORE AND AFTER ELECTRON RADIATION (thesis). Leon L. Kortz. Mar. 1960. 52p.

The physical properties of three meta-linked polyphenyl ethers were investigated both before and after irradiation to 1×10^{11} ergs/g °C by electrons. All three, m-diphenoxybenzene, bis (m-phenoxyphenyl) ether, and m-bis(m-phenoxyphenoxy) benzene, exhibited greater than 40% increase in kinematic viscosity at temperatures below 210°F after irradiation. No other significant changes occurred in the physical properties that were investigated except for the heat capacity of m-bis(m-phenoxyphenoxy) benzene which decreased by roughly 20% over the entire temperature range, 100 to 700°F. A method for estimating the heat capacity was experimentally verified. The calculated values of heat capacity varied less than 8% on the average from the experimental values. The maximum error was 13%. It is concluded that the meta-linked polyphenyl ethers are ideally suited for use in a high-temperature and a radiation environment. (auth)

22107 ANL-6143

Argonne National Lab., Ill.
IRRADIATION OF AN ALUMINUM ALLOY-CLAD CERAMIC PELLET-FUELED PLATE. A. P. Gavin. May 1960. 45p. Contract W-31-109-eng-38. OTS.

An aluminum-nickel alloy-clad ceramic-fueled plate of

the BORAX-IV type was examined destructively after irradiation to a maximum burn-up of 7,800 Mw days per ton in the circulation water loop in the MTR. Irradiation was at 600 psig and 465°F, with local boiling in the area of highest neutron flux and a maximum heat flux of 500,000 Btu/(hr)(ft^2). The specimen performed satisfactorily in spite of several factors which made conditions more severe than those expected to exist in a reactor fueled with this type of element. The corrosion rate of the aluminum-nickel cladding on the element was approximately 10 mils per year. Only slight breakup of the ceramic pellet fuel was experienced and there was no evidence that the degree of cracking was influenced to any appreciable extent by exposure to radiation. (auth)

22108 BMI-1452

Battelle Memorial Inst., Columbus, Ohio.

IRRADIATION EFFECTS ON MASSIVE URANIUM MONOCARBIDE. Alan W. Hare and Frank A. Rough. July 21, 1960. 31p. Contract W-7405-eng-92. OTS.

The results of examinations of UC compounds having nominal compositions of uranium-4.6, −4.8, and 5.0 wt. % carbon after irradiation to burnups of from 400 to 15,000 Mwd/t of uranium are given. Density changes were small, varying from a minimum of 0.3% to a maximum of about 2.5%. Cracking occurred in all specimens; however, it can probably be largely attributed to thermal stresses and to oxidation, after decapsulation, of NaK entrapped in microcracks. Depletion of carbon appears to be occurring in the specimens having the nominal uranium-5 wt. % carbon composition. Metallographic examination shows that the UC_2 phase disappears at high temperature and high burnup. The fission-gas-retention properties of the compounds appear quite good. In all cases, the amount of fission gas released was comparable with the calculated amount released by recoil. (auth)

22109 BMI-BW-651 & Add.

Battelle Memorial Inst., Columbus, Ohio

EXPERIMENTAL IRRADIATION STUDIES ON UO_2-CONTAINING FUEL ELEMENTS FOR THE NUCLEAR MERCHANT SHIP REACTOR PROGRAM. Gerald E. Lamale, John C. Smith, Alan W. Hare, and Ronald F. Dickerson. Nov. 11, 1959. 50p. For Babcock and Wilcox Co. Atomic Energy Div. OTS.

Two series of capsules containing UO_2 clad with stainless steel were irradiated in ETR for the purpose of studying the properties after a moderate burnup in an efficiently cooled capsule in one series and a moderate burnup in a capsule designed to simulate the condition of overpower in the other series. Specimens in the first series of three capsules had an enrichment of 4% and were irradiated to a burnup of 0.1% U. The UO_2 did not show any significant effects that could be definitely attributed to radiation. Specimens in the second series of three capsules had an enrichment of 3% and were irradiated to a burnup of 0.05% U. Low-conductivity materials of low thermal neutron absorption cross section were used to surround the specimens and thermally insulate the fissioning UO_2. The UO_2 showed considerable change as a result of irradiation, chiefly in the formation of columnar grains and central voids in all three capsules. A sample of fission gas was taken from one of the capsules and its analysis for Xe^{133} indicates that only approximately 5×10^{-3}% was released from the UO_2. (auth)

22110 CEA-1380

France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucleaires, Saclay.

DISPOSITIFS D'IRRADIATION D'EPROUVETTES D'ACIER DANS LA PILE G 1 DE MARCOULE. (Apparatus of Irradiation of Steel Test Pieces in the Marcoule Pile G 1). R. Marinot and Ph. Wallet. 1960. 25p.

Steel specimens were irradiated in Marcoule Reactors (G-1) in convectors which replaced fuel elements and in vertical channels in furnace-heated containers. The apparatus for the irradiation is described relative to the following components: containers, converter-rods, suspension fixtures and clamps, temperature measurement devices, lead castles, and unloading set-ups. (C.J.G.)

22111 CF-60-6-78

Oak Ridge National Lab., Tenn.

IRRADIATION EFFECTS ON UC_2 DISPERSED IN GRAPHITE. (ORNL-MTR-48-1), INTERIM REPORT NO. 1. J. G. Morgan and M. F. Osborne. Aug. 18, 1960. 13p. OTS.

A dispersion of enriched (93 wt. % U^{235}) UC_2 in graphite was irradiated in the MTR to a burnup of 7560 Mwd/T of fueled matrix, with average fission power densities of 270 and 300 w/cm^3. Preliminary examinations in the hot cell showed no external dimensional changes to the graphite cans enclosing the fuel cylinders. One fuel cylinder showed a 2.4 to 5.1% decrease in diameter and a 3.5% increase in length. (auth)

22112 CRMet-908

Atomic Energy of Canada Ltd., Chalk River, Ont.

THE RELEASE OF STORED ENERGY FROM NEUTRON-IRRADIATED LITHIUM FLUORIDE. B. G. Childs and J. McGurn. Mar. 1960. 57p. (AECL-1039). AECL.

The rate of release of stored energy from irradiated LiF samples was measured as a function of temperature and neutron exposure. A major release peak, for a specimen heating rate of 9×10^{-2} °C/sec, occurred for all samples at about 400°C. Two secondary peaks were observed, one higher and one lower in temperature than the main peak. The total energy released varied from 7.0 cal/g for an exposure of 3.7×10^{16} n/cm^2 to 151.9 cal/g for 1.1×10^{19} n/cm^2. Considerable differences were found between the stored-energy behavior, gas release, and post-irradiation microstructure of two LiF crystals used in the work. Possible reasons are discussed for these differences as well as for the features common to the energy release behavior of both crystals. (auth)

22113 NAA-SR-Memo-2156

Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

IRRADIATION DAMAGE IN METAL FUELS: A LITERATURE SURVEY. Gordon Bentle. Oct. 8, 1957. Decl. June 13, 1960. 20p. OTS.

Accepted concepts of irradiation damage in metallic fuels are discussed. The irradiation effects are divided into low-temperature (below 400°C) and high-temperature effects. The low-temperature effects are characterized by shape changes while the high-temperature effects are characterized by changes in fuel specimen volume. Central fuel temperatures are given, the respective surface temperatures being 10 to 100°C lower. Fundamental theories and discussion are included. 41 references. (J.R.D.)

22114 REIC-12

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

THE EFFECT OF NUCLEAR RADIATION ON ELECTRONIC COMPONENTS. D. J. Hamman, W. E. Chapin, J. F. Hansen, and E. N. Wyler. Apr. 30, 1960. 74p. Project No. 2133. Contract AF33(616)-6564.

Information is presented to cover the state of the art of knowledge on the effects of nuclear radiation on basic electronic parts. It represents an addendum to REIC Report

No. 8. It relates the observed degradation of electrical characteristics of each device to the materials used in the construction of the device. The statements made are not intended to be design oriented, but rather to survey the relative radiation sensitivity of electronic components, and to provide a basis for judging the merits of any technical approach for applying electronic circuitry in a radiation environment. It contains an expanded section on electron tubes and contains information on electronic parts that were not considered in previous similar status reports. (auth)

22115 REIC-13

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

THE EFFECT OF NUCLEAR RADIATION ON PROTECTIVE COATINGS. Ramona A. Mayer, Norman J. Broadway, and Stephen Palinchak. July 15, 1960. 58p. Project No. 2133. Contract AF33(616)-7375.

The state of the art on the effects of nuclear radiation on protective coatings through May 1960 is reported. The available radiation-effects information on various coatings and coating systems including pigments is summarized. Information on electrical and thermal insulation was not included. The report is intended to be sufficiently inclusive to make it valuable as a guide on effects which can be anticipated from nuclear radiation on protective coatings. (auth)

22116 TID-6197

Pennsylvania State Univ., University Park.

EFFECT OF RADIATION ON DYNAMIC PROPERTIES OF HIGH POLYMERS. Progress Report [for] July 1, 1959 to June 30, 1960. J. A. Sauer and A. E. Woodward. July 1, 1960. 27p. Contract AT(30-1)-1858. OTS.

The radiation effects on isotopic polypropylene and polyethylene were investigated at 25, 75, and 125°C at dosages up to 5×10^8 rep. Crosslinking efficiency, mechanical loss, and dynamic elastic storage modulus were investigated for irradiated polyethylene at 77 to 450°K. Measurements of sound velocity and propagation in polyethylene, polystyrene, and other materials were made in the 1.3×10^{-3} to 10^7 cps range at 20°C. Proton magnetic resonance measurements of poly(pentene-1), poly(3-methyl butene-1), and poly(4-methyl pentene-1) were made at 77 to 400°K. NMR second moments were calculated and experimentally determined for poly(methyl methacrylate), poly(methacrylic acid), poly(sodium methacrylate), and poly(alpha methyl styrene) at 77 to 435°K. NMR studies on polyethylene and other paraffinic materials at 77 to 395°K revealed that considerable motion takes place at 25 to 70°K below the melting points of the materials. The effect of H_2O and D_2O on the NMR spectra of 6-10 and 10-10 nylons greatly increased the segmental mobility. The effect of N-methylation increased chain mobility. Proton magnetic resonance measurements were made on sodium polyglutamate, partially crystalline polystyrene swollen with CCl_4, polyvinyl chloride, polyvinylidene chloride, and polyoxymethylene. A two-electrode, three-terminal capacitor was constructed for measurements of both the complex dielectric constant and the expansion coefficients of certain polymers in the solid state down to liquid helium temperatures. (For preceding period see NYO-7500.) (C.J.G.)

22117 UK-10

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

EUROPEAN ATOMIC ENERGY SOCIETY—STOCKHOLM 1959—THE EFFECT OF IRRADIATION UPON BERYLLIUM. Robert S. Barnes. 3p.

Beryllium undergoes two nuclear reactions with fast neutrons. The effects on the material become more important at high doses and operating temperatures. A discussion of these effects is presented with brief reference to those of the normal atomic displacements. (J.R.D.)

22118 DEGIS-60(C)

THE BEHAVIOUR OF ELECTRICAL STRAIN GAUGES UNDER THE INFLUENCE OF IRRADIATION. H. Buehler and W. Schreiber. Translated by J. R. Pentland (U.K.A.E.A., Culcheth) from Atomkernenergie 4, 138-40 (1959). 6p.

Rapid decline in the insulation resistance of electrical strain gages was noted during the period of irradiation. For the slide wire, constantan appeared to be better than Ni—Cr. (C.J.G.)

22119

EFFECTS OF FAST NEUTRON IRRADIATION ON THE STRUCTURE AND MAGNETIC PROPERTIES OF NICKEL FILMS. I. Teodorescu and A. Glodeanu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 331-40(1960). (In Rumanian)

The effects of fast neutron irradiation on the structure and the magnetic properties of nickel films evaporated in vacuum were studied. The films were irradiated in vacuum and in oxygen at two flux levels, $\phi = 3.38 \times 10^{17}$ n/cm^2 and $\phi = 9.45 \times 10^{15}$ n/cm^2. The films irradiated in vacuum are transformed from face-centered crystals to hexagonal crystals totally or partially as a function of the flux intensity. Because of this transformation, the magnetic properties are cancelled or greatly decreased, with the exception of the coercive force which increases slightly when the irradiation is made with the less intense flux. The samples irradiated in oxygen are transformed into hexagonal crystals only in a very small proportion because the oxide layer prevents this phase transformation. The results given by electron diffraction, electron microscopy, and magnetic measurements all agree. An attempt is made to explain these results by supposing the formation of thermal points of relatively large dimensions, different both from the Seitz thermal points and the Brinkman displacement points. (tr-auth)

22120

THE EFFECT OF NEUTRON BOMBARDMENT ON THE MAGNETIZATION CURVE OF SILICON IRON SINGLE CRYSTALS. V. V. Klyushin (Inst. of Metal Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 132, 102-3(1960) May 1. (In Russian)

Monocrystals of transformer steel prepared by annealing after cold rolling were used in order to determine qualitatively the influence of neutron irradiation on boundary displacements in the ferromagnetic regions and their magnetization rotation processes. The integral irradiation dose was 4.7×10^{18} n/cm^2 at a temperature of 50°C. The results show enlarged hysteresis loops in silicon iron monocrystals (3% Si). The coersive force of monocrystals magnetized in the (001) direction increased from 0.3 to 0.8 gauss and in the (111) direction from 1 to 1.2 to 1.3 gauss. Thus, it is indicated that neutron irradiation influences boundary displacement. However, the obtained data are not sufficient to clarify the mechanisms inducing magnetization variations. (R.V.J.)

22121

THE EFFECT OF RADIATION ON THE POTENTIAL OF A PLATINUM ELECTRODE IN A SULPHURIC ACID SOLUTION. D. V. Kokoulina, P. I. Dolin, and A. N. Frumkin

(Inst. of Electrochemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 132, 880-3(1960) June 1. (In Russian)

The behavior of a smooth Pt electrode in H_2SO_4 solution was studied during irradiation with maximum doses of $\sim 3 \times 10^{17}$ and $\sim 7 \times 10^{16}$ ev/cm^3/sec. The results showed that under irradiation the Pt electrode potential in 0.8 N H_2SO_4 is determined by accumulated molecular products of radiolysis (hydrogen and hydrogen peroxide). Radicals do not participate in the potential since most of them are recombined in the solution and on the surface. (R.V.J.)

22122

DISPLACEMENT OF ATOMS IN A SOLID BODY BY GAMMA RAYS. V. V. Galavanov (Leningrad Physical-Chemical Inst.). Fiz. Tverdogo Tela 1, 432-41(1959) Mar. (In Russian)

The mechanism of the formation of the Frenkel defect, the existence of an atom in an interstice together with an empty lattice site, under the action of gamma rays is investigated. The cross section for the formation of a Frenkel defect is defined for elastic scattering, for photoeffect, and for the elastic scattering of a fast photoelectron or Compton electron. A thick crystal was used for the last two cases, choosing crystal thicknesses which were much larger than the mean free path of the electron. The method of graphical integration used allows the calculation of the spectrum of the scattered electrons according to their energy. For Ge bombarded by 1.25 Mev gamma rays, the cross sections for the formation of a Frenkel defect are as follows: for scattering $\simeq 2 \times 10^{-29}$ cm^2; for the photoeffect $\simeq 1 \times 10^{-27}$ cm^2; for the fast photoelectron $\simeq 1 \times 10^{-26}$ cm^2; and for the Compton electron $\simeq 2 \times 10^{-25}$ cm^2. (TTT)

22123

THEORY OF THE SPATIAL DISTRIBUTION OF RADIATION DAMAGE IN A SILICON CRYSTAL LATTICE UNDER IRRADIATION BY A MONOENERGETIC BEAM OF ELECTRONS. B. Ya. Yurkov (Lebedev Inst. of Physics, Moscow). Fiz. Tverdogo Tela 1, 696-704(1959) May. (In Russian)

Spencer's method, devised for the calculation of the spatial distribution of the energy loss of a beam of electrons, was applied for the determination of the spatial distribution $\Sigma(x)$ of radiation damage in a silicon crystal lattice. The moments of the distribution Σ_n were determined with the help of a certain generalization of the Spencer correlation for moments of the distribution of the residual ranges Σ_n^R. The resulting moments Σ_n were approximated, in contrast to Spencer, by a single function which gave the correct asymptotic behavior of the sought-for distribution $\Sigma(x)$. In view of the substantial contribution of the back-scattering, this method of approximation (due to Adawi) was adjusted so that separate approximations were carried out for odd and even distributions. The theory is illustrated by an example, for which the calculations show agreement with experimental results. (TTT)

22124

BEHAVIOR OF METALLIC URANIUM UNDER IRRADIATION. Paolo Spinedi (Università, Rome). Ing. nucleare 3, 71-80(1960) Mar.-Apr. (In Italian)

Under the irradiation to which it is subjected in nuclear reactors, uranium undergoes several macroscopic and microscopic changes, whose origin is highly complex. First and foremost, the three types of damage that uranium suffers under these conditions are growth, wrinkling, and swelling. In this regard, three factors that may affect the extent of damage were taken into consideration, i.e. such mechanical and heat treatments as the material undergoes during the processing of fuel elements; the alloy elements that are introduced into the composition of the elements; and irradiation conditions, especially instantaneous flux. An examination is made of such uncertain knowledge as we have today of the changes that occur in the mechanical properties of uranium under irradiation. Mention is made of the results achieved by recent research into special structures obtained by sintering or by dispersion of UO_2. (auth)

22125

THE EFFECT OF BETA RAYS ON THE PHOTOLUMINESCENCE OF MOLECULAR CRYSTALS. Sh. D. Khan-Magometova, N. D. Zhevandrov, and V. I. Gribkov (Lebedev Inst. of Physics, Moscow). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 561-6(1960) May. (In Russian)

A study is made of the effect of beta rays from Sr^{90} and H^3 on the photoluminescence of crystals of pure anthracene and of anthracene with naphthacene at various concentrations. Exposing samples of pure anthracene to Sr^{90} beta rays for 3 to 6 days reduces the luminescence (I) to 16% of the value before exposure (I_0). With 10 ppm naphthacene in the anthracene $I/I_0 = 72\%$; with 5000 ppm, $I/I_0 = 95\%$. The beta rays from H^3 produce a smaller effect because of their lower energy. It is concluded that the mechanism is partially the destruction of the luminescing molecules and partially the formation of quenching centers. (TTT)

22126

THE KINETICS OF GAMMA-RAY INDUCED COLORING OF GLASS. Paul W. Levy (Brookhaven National Lab., Upton, N. Y.). J. Am. Ceram. Soc. 43, 389-95(1960) Aug.

When glasses are colored by ionizing radiation the induced optical absorption increases as the radiation progresses and appears to be due to the superposition of a number of individual absorption bands. A detailed study of this process was made using a specimen of Corning borosilicate glass colored by exposure to Co^{60} gamma rays. This particular sample was chosen because only four bands are formed. If it is assumed that each band is Gaussian shaped the spectrum may be separated into four absorption bands. The peak energy E_0 and full width U of these bands are, in electron volts: $E_0 = 4.85$, U = 1.19; $E_0 = 3.95$, U = 1.30; $E_0 = 2.58$, U = 0.58; $E_0 = 2.02$, U = 0.52. For each band growth curves may be constructed showing how the density of absorption centers increases as a function of dose. These growth curves were fitted with theoretical curves based on the following considerations: the radiation field creates ionization electrons in the glass; for each ionization electron one electron deficient region or hole is formed; absorption bands observed are due to centers formed by electron trapping although the possibility that some of the bands are due to hole trapping is not ruled out; and competition for ionization electrons exists between holes and the various kinds of electron traps. Satisfactory agreement between the observed and calculated curves is obtained. The theory indicates that the "radiation protection" imparted to glass by materials such as CeO_2 may arise in several different ways and that it would be possible to decide between them from rather simple experiments. (auth)

22127

TRAPPED ELECTRONS IN IRRADIATED QUARTZ AND SILICA: I. OPTICAL ABSORPTION. C. M. Nelson and R. A. Weeks (Oak Ridge National Lab., Tenn.). J. Am. Ceram. Soc. 43, 396-9(1960) Aug.

Evidence is given for the correlation between an optical absorption band at 2300 au and an electron spin reso-

nance system developed in quartz after Co^{60} γ irradiation. The results of bleaching γ irradiated quartz and silica at 78°K and at room temperature are presented and discussed. Also, further observations upon annealing these color centers are given. (auth)

22128

TRAPPED ELECTRONS IN IRRADIATED QUARTZ AND SILICA: II. ELECTRON SPIN RESONANCE. R. A. Weeks and C. M. Nelson (Oak Ridge National Lab., Tenn.). J. Am. Ceram. Soc. 43, 399-404(1960) Aug.

The correlation of two paramagnetic defects, observed by the electron spin resonance (ESR) technique, with two optical absorption bands produced by γ-ray or neutron irradiation is indicated. The peaks of the two absorption bands fall at ~2100 and 2300 au. The effective g values for the ESR lines, for a crystal orientation with respect to the magnetic field of [00.1] parallel to $\overline{H}$, are 2.0006 ± 0.0005 for the 2100 au band, and there are two lines observed for the 2300 au band at [g = 2.0007 and g = 2.0009] ± 0.0005. The correlation of the optical bands and ESR lines was established by a series of bleaching and annealing experiments. These experiments also establish the presence of another center which is not observed directly by either the optical or the ESR technique. ESR lines were observed which were attributed to a hyperfine interaction, A = 7.7 gauss, of the g = 2.0006 (2100 au band) defect with the Si^{29} isotope (I = ½, 4.7% abundance). Models for these defects, consistent with the experimental data, are suggested. (auth)

22129

EFFECTS OF ELECTRON BOMBARDMENT ON PROPERTIES OF VARIOUS GLASSES. T. M. Mike, B. L. Steierman, and Ed. F. Degering (Owens-Illinois, Toledo). J. Am. Ceram. Soc. 43, 405-7(1960) Aug.

Soda-lime, borosilicate, and lead glass specimens were exposed to various dosages of 2 Mev electrons. The effects of the irradiation on flexural strength, density, chemical durability, heat of solution, and electrical resistivity were investigated. For dosages up to 300 megareps several small effects were noted but were considered to be of minor significance as far as bottle serviceability was concerned. (auth)

22130

EFFECTS OF ELECTRON BOMBARDMENT ON ELASTICITY AND MECHANICAL DAMPING OF CERTAIN GLASSES. S. W. Barber, K. E. Forry, and D. F. Degering (Owens-Illinois, Toledo). J. Am. Ceram. Soc. 43, 408-12 (1960) Aug.

A borosilicate glass and a lead-containing silicate glass were exposed to various dosages of 2 Mev electrons, and the effects on the logarithmic decrement and period of a freely oscillating torsional pendulum in which each was made the torsional member were noted. These effects, in both glasses, are qualitatively described as disannealing. Quantitatively, tan δ was increased 10 to 15% in the borosilicate and 30 to 60% in the lead glass, and the corresponding decreases in rigidity were of the order of 0.4 and 2%, respectively. In both glasses the mechanical effects and the associated brownish color annealed out in about 20 hours at 500°F. Besides these effects, there were some completely unexpected effects which are reported for the first time and should be verified by others. These consist of (1) changes in the shape of tan δ vs. temperature curves caused not only by thermal treatment but also by changes in period of the pendulum and (2) fine structure in the tan δ vs. temperature maxima due to sodium ion diffusion. These details complicate the interpretation of such maxima and, if verified, will justify a re-examination of the anelastic behavior of glasses in general and borosilicate glasses in particular. (auth)

22131

A GAMMA-RAY INDUCED ABSORPTION BAND IN SOME LEAD BORATE GLASSES. Adli M. Bishay (Argonne National Lab., Ill.). J. Am. Ceram. Soc. 43, 417-21(1960) Aug.

Observations made on some lead borate, lead aluminoborate, and lead boroaluminosilicate glasses showed that an absorption band is induced at 1.5 ev (825 mμ) by gamma irradiation. Experimental evidence indicates that this band is associated with Pb^{2+} ions and boron in the structure of these glasses. On replacing PbO by Tl_2O in a borate glass, two strong bands were observed; one band corresponds to the 1.5 ev band induced in lead borate glasses and a completely new band at 1.0 ev (1235 mμ). A postulate for the center responsible for the absorption band at 1.5 ev is proposed. (auth)

22132

APPLICATIONS OF RADIATION EFFECTS IN GLASSES IN LOW- AND HIGH-LEVEL DOSIMETRY. G. E. Blair (Bausch and Lomb Optical Co., Rochester, N. Y.). J. Am. Ceram. Soc. 43, 426-9(1960) Aug.

Two types of dosimetry using special glasses as sensing elements are reviewed. Both systems give an integrated total dose measurement. One system is based on a change in luminescence with dose and covers the range 10 to 10,000 rads. The second system is based on an optical absorption change with dose and covers the range 10^4 to 10^7 rads. (auth)

22133

PARAMAGNETIC-RESONANCE STUDIES OF IRRADIATED HIGH-DENSITY POLYETHYLENE. I. RADICAL SPECIES AND THE EFFECT OF ENVIRONMENT ON THEIR BEHAVIOR. Elliott J. Lawton, J. S. Balwit, and R. S. Powell (General Electric Co., Schenectady, N. Y.). J. Chem. Phys. 33, 395-404(1960) Aug.

Linear polyethylene (Marlex-50) was irradiated at different temperatures with 800-kv (peak) electrons. It was examined for paramagnetic resonance at +25 and −196°C to determine the radical species and their postirradiation behavior as well as that of the crystalline trapping medium. At low doses the spectrum is composed of two radical species which decay at different rates at room temperature. The predominant radical decays to zero in about five days; its six-line hyperfine structure is attributed to $-CH_2-\dot{C}H-CH_2-$. The fast decay supports a previous suggestion that the polymer radicals are formed in pairs on adjacent chains. The other radical has a basic five-line spectrum with additional "very fine" structure. It lasts for months at room temperature. The behavior of the "very fine" structure on cooling to liquid-nitrogen (LN) temperature and the initial low concentration of the radical suggest its probable structure to be $-CH_2-H_2C\cdot|\cdot CH_2-CH_2-$. The relative numbers of each radical trapped at room temperature depend on the rigidity of the crystal and, therefore, on temperature during irradiation. The six-line radical pairs exist as several groups decaying at different rates at room temperature. The half-life of the fastest decaying group was 10 sec, that of the slowest, 25 hr. The fastest group comprises pairs in which the two radicals are formed nearly opposite each other on adjacent chains. They cause spin-spin line broadening in the time-zero LN spectrum. The decay rate of the radical pair is determined by the rigidity of the crystal. An apparent transition point for the crystal exists at −70°C, below

which there is only a slight decay of the closest-spaced radicals. The total number of radicals produced and trapped by 40 megaroentgens at LN temperature was 6.2×10^{19}/g which corresponded to a G(total radicals) = 3.0. (auth)

22134

PARAMAGNETIC-RESONANCE STUDIES OF IRRADIATED HIGH-DENSITY POLYETHYLENE. II. EFFECT OF IRRADIATION DOSE ON THE RADICAL SPECIES TRAPPED AT ROOM TEMPERATURE. Elliott J. Lawton, J. S. Balwit, and R. S. Powell (General Electric Co., Schenectady, N. Y.). J. Chem. Phys. 33, 405-12(1960) Aug.

A study of the radical species in irradiated Marlex-50 at 4000-megaroentgens dose is presented. The kind and relative number of each radical trapped at room temperature (RT) depends on the degree and tightness of the crystalline and crosslinked fractions during irradiation. At least two of three distinct species, having different hyperfine structures (six-, five-, and a single-line) are present in varying concentrations at all doses. The six- and five-line radicals are trapped in the crystal, whereas the single-line radical is trapped in the highly crosslinked medium. During irradiation at RT and liquid-nitrogen (LN) temperature, the crystal is not as effective in trapping the six-line radical as in the absence of irradiation. At 640 megaroentgens the six-line radical does not survive during irradiation at RT, leaving the five- and single-line radicals above this level. The single-line radical appears at 320 megaroentgens and increases until at 3000 megaroentgens, where crystallinity is zero, it accounts for about 70% of the total. Heating the irradiated samples causes all radicals to disappear; the "extinction temperatures" for the six-, five-, and single-line radicals were 90, 135, and about 250°C, respectively. The relative effectiveness of the preirradiated annealed samples compared to the nonirradiated Marlex-50 in trapping radicals at RT was 0.5 for the 20-megaroentgen, 1.0 for the 320-megaroentgen, and 1.4 for the 4000-megaroentgen preirradiated material. There is evidence in the μ-v spectrum for conjugated double bonds in the highly irradiated samples. It is proposed that the single-line radical is initially formed adjacent to the conjugated sequence and then becomes trapped within the sequence by resonance. The radical could be represented as $-CH=CH-CH=CH-\dot{C}H-CH=CH-CH=CH-$. (auth)

22135

PARAMAGNETIC RESONANCE OF GAMMA-IRRADIATED SINGLE CRYSTALS OF ICE AT 77°K. J. A. McMillan, M. S. Matheson, and B. Smaller (Argonne National Lab., Ill.). J. Chem. Phys. 33, 609-10(1960) Aug.

The anisotropy of the paramagnetic resonance spectra of ice crystals irradiated and measured at 77°K was studied in an effort to identify the paramagnetic species indicated by previous experiments. The doses were $\sim 10^{21}$ ev/cc each, and the spectra were obtained with the c axis parallel and perpendicular to the axis of rotation, which was kept perpendicular and parallel to the static and microwave magnetic fields, respectively. The parallel run showed sixfold symmetry while the perpendicular run showed one canonical orientation with a minimum doublet separation, a maximum g value, and two mirror planes. The spectra show twelve-fold periodicity at 15° orientations to each mirror; the results are interpreted in terms of a cylindrically symmetric radical. Polycrystalline ice was also examined, giving two lines with sixfold symmetry in the parallel run; this result indicates the presence of H_2O^+. (D.L.C.)

22136

ELECTRON-MICROSCOPIC OBSERVATIONS ON RADIATION DAMAGE IN GRAPHITE. W. Bollmann (Battelle Memorial Inst., Geneva). Phil. Mag. (8) 5, 621-4(1960) June.

Transmission electron microscopy was applied to the study of lattice defects introduced by neutron irradiation of graphite. The dark-field technique proved to be especially useful for this purpose. The technique of preparation is described and a tentative interpretation of the observations is given. (auth)

22137

THE GENERATION OF VACANCIES IN METALS. R. S. Barnes (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8) 5, 635-46(1960) June.

The regions where injected helium atoms first appear as gas bubbles are those where thermal vacancies originate. Microscopic examination of metals, injected with helium by using them as targets for energetic alpha particles, revealed grain boundaries as the principal suppliers of vacancies. Detailed examination distinguished those boundaries which generated vacancies from those which merely conducted them. The behavior and nature of these boundaries and other vacancy sources are discussed. (auth)

22138

A REVIEW OF THE GROSS STRUCTURAL EFFECTS OF ENERGETIC ATOMIC PARTICLES ON VITREOUS AND CRYSTALLINE SILICA. W. Primak (Argonne National Lab., Ill.). Phys. and Chem. Solids 13, 279-86(1960) June. (In English)

The course of the changes resulting from irradiation and also those found on post-irradiation heating are reviewed. A hypothesis of the atomic behavior which will account for the observation is given. (auth)

22139

REACTOR AND GAMMA-RAY INDUCED COLORING OF CORNING FUSED SILICA. P. W. Levy (Brookhaven National Lab., Upton, N. Y.). Phys. and Chem. Solids 13, 287-95(1960) June. (In English)

When crystalline quartz, fused silica, and many other substances are subject to reactor or gamma radiations the samples develop optical absorption bands in the region 0.2 to 1 μ. Usually, there are many broad bands which overlap and resolution of the observed spectrum into the component bands is difficult. Corning fused silica is colored less than all of the materials studied and the observed spectrum can be resolved into its components by properly utilizing the variations in the relative absorption of the different bands created by changing the irradiation conditions. The most intense band is near 5.75 ev (218 mμ) and there is a smaller one at 5.05 ev (242 mμ) when the sample is irradiated in the reactor at 70°C. The 5.05 ev band has, relative to the 5.75 ev band, low intensity when the reactor irradiation is at 170°C but is much stronger when the irradiation is at liquid nitrogen temperature. Also, the peak of the 5.75 ev band shifts slightly with irradiation temperature. The band at 5.05 ev, which can be separated from the other bands without assuming a shape for it, is well fitted by a Gaussian curve and we have assumed that all other bands are similarly shaped. When a sample originally colored in the reactor is subsequently subjected to gamma rays, additional absorption bands appear and their intensity is proportional to both the reactor and gamma-ray exposures. In all, new bands at approximately 5.5 (223 mμ), 4.5 (278 mμ), 2.0 (625 mμ), and one near 6.1 (200 mμ) ev, are present with indications of four others. (auth)

22140

OPTICAL ABSORPTION IN IRRADIATED QUARTZ AND

FUSED SILICA. C. M. Nelson and J. H. Crawford, Jr. (Oak Ridge National Lab., Tenn.). Phys. and Chem. Solids 13, 296-305(1960) June. (In English)

Optical absorption studies over the range from 1850 to 26,000 A, were performed on crystalline quartz and fused silica after exposure to both fast neutrons in the reactor and Co^{60} γ rays. The prominent band near 2150 A is produced by γ rays and neutrons in fused silica but fast neutron exposures in excess of 5×10^{18} cm^{-2} are necessary to cause appreciable development of the corresponding band in crystalline quartz. With shorter neutron exposures and γ rays the absorption in quartz crystals is characterized by the broad visible bands and continuous absorption which rises almost linearly toward shorter wavelengths below 3000 A. This continuous absorption probably corresponds to the long wavelength tail of one of the bands observed by Mitchell and Paige in the vacuum ultraviolet region. These results do not seem to agree with their interpretation of the nature of the 2200 A band in quartz. On annealing neutron-irradiated quartz (5×10^{18} neutrons/cm^2) at 250°C a new band at 2000 A develops. In fused silica, besides the 2150 A band, the shoulder at 2400 A (resolved by appropriate optical bleaching as a band at 2570 A) which has previously been reported, was observed with both γ rays and fast neutrons. The rates of coloration of quartz and fused silica as well as studies of optical and thermal bleaching are discussed. In the fused materials a mechanism of photolytic coloration which appears to be consistent with observations provides a suitable model which is based on the rupture of Si—O bonds with the formation of free radicals as the principal product. These and other possible defects are discussed in the light of magnetic susceptibility and electron spin resonance studies. (auth)

22141

DEFECTS IN NATURAL AND SYNTHETIC QUARTZ. G. W. Arnold, Jr. (U. S. Naval Research Lab., Washington. D. C.). Phys. and Chem. Solids 13, 306-20(1960) June. (In English)

Thermoluminescence measurements of quartz (both irradiated and naturally colored) were made from room temperature to 375°C. Various peaks of the light intensity vs. temperature curves were identified with absorption maxima in the 190 to 1000 mμ spectral region. The method is extremely sensitive to radiation dose, well-defined peaks being observed for very short x-irradiation times (~1 sec). Data from literature are presented on x-irradiated natural quartz, smoky quartz and on x-irradiated synthetic quartz with various additives. (auth)

22142

SUBSTITUTIONAL AND INTERSTITIAL ALUMINUM IMPURITY IN QUARTZ, STRUCTURE AND COLOR CENTER INTERRELATIONSHIPS. A. J. Cohen (Mellon Inst., Pittsburgh). Phys. and Chem. Solids 13, 321-5(1960) June. (In English)

That color centers in the 460 and 625 mμ regions of the quartz spectrum are related to substitutional aluminum impurity is now well established. Indirect evidence has indicated that interstitial aluminum may appear in quartz. Buerger has discussed the stuffing of quartz by β-eucryptite, $LiAlSiO_4$, with cell dimensions a little more than double those of β-quartz. Recently, other workers have found that β-spodumene, $LiAl(SiO_3)_2$, is also isomorphous with β-quartz. General Electric Co. synthetic quartz grown from a Z-seed was found in this laboratory to contain in ppm Si atoms: 290 Al; 260 Li; 8 Fe; and 131 Na. X irradiation for long periods gave no change in the optical absorption of this quartz down to 1850 A. It was concluded that the aluminum present was interstitial. An attempt to precipitate the interstitial aluminum and lithium was successful. This separate phase was found to "decorate" the macromosaics and to indicate the manner of growth of synthetic quartz on various seed orientations. Small regions of rhombohedral growth on General Electric Co. Z-seed crystals did color due to the substitutional aluminum content. There was no precipitation of interstitial aluminum in these regions. The increase of the spin-lattice relaxation time of the Si^{29} nucleus after precipitation indicates that the paramagnetic trace impurity in Z-seed crystals is also interstitial. Precipitation experiments on Y-bar synthetic quartz coupled with x irradiation indicate that the trace of aluminum present in the Z-zones is interstitial and that the major portion of the aluminum in the X_{fast} zone is substitutional, while the aluminum in the X_{slow} zone is both substitutional and interstitial. The color banding in x-rayed Y-bar crystals is discussed as well as the dependence of the intensity of the smoky color (due to the aluminum color center system) on the crystallographic orientation of the growing zone and how this can be used to identify the different vicinal faces and their "birth" during growth of the crystal. Mention is made of the effects of germanium (IV) ion on the substitutional aluminum content of the Z-zones. (auth)

22143

INFRARED ABSORPTION OF DEFECTS IN QUARTZ. D. L. Wood (Bell Telephone Labs., Inc., Murray Hill, N. J.). Phys. and Chem. Solids 13, 326-36(1960) June. (In English)

A number of sharp absorption bands in the infrared spectrum of crystalline α-quartz between 3200 and 3655 cm^{-1} were assigned to defects in the lattice. Defects containing water may cause a broad absorption through this region of the spectrum in very imperfect parts of certain crystals, but it does not contribute to the sharp bands observed. One band at 3581 cm^{-1} is probably due to the OH stretching vibration of a proton defect, but the other peaks are not. Treatments of the crystal involving x irradiation, heat bleaching, annealing or heating in an electric field strongly affect the intensities of the bands observed, and it is concluded that the bands originate in color centers with an electronic origin. Probably more than one type of center is involved. No correlation with the visible color centers of smoky quartz or amethyst is observed. Interstitial foreign atoms play an important role in the formation of the infrared centers but vacancies or interstitial Si or O atoms are probably not involved. Although much information relating to the infrared color centers is available the full details of their structure are not yet known. (auth)

22144

THE ANELASTICITY OF NATURAL AND SYNTHETIC QUARTZ AT LOW TEMPERATURES—ABSTRACT. J. C. King. Phys. and Chem. Solids 13, 352(1960) June. (In English)

Certain imperfections in alpha quartz are found to introduce anelastic absorption at low temperatures in crystal resonators. For a shear wave of 5 mc, absorption peaks are observed at approximately 20 and 50°K in unirradiated samples. X irradiation effects a lowering of the amplitude of the 50°K absorption, while a new absorption is introduced at 100°K. The results of acoustic absorption measurements on a number of selected samples of synthetic quartz resonators suggest that, whereas the 50°K absorption is attributable to excess oxygen, the 100°K defect involves aluminum which is present substitutionally in the crystal structure. X-irradiation-induced lowering of the resonant frequency of crystal resonators is clearly the re-

sult of a lowering of the elastic modulus associated with the 100°K anelastic absorption. (auth)

22145

RADIATION EFFECTS OF BOMBARDMENT OF QUARTZ AND VITREOUS SILICA BY 7.5-kev TO 59-kev POSITIVE IONS. R. L. Hines and R. Arndt (Northwestern Univ., Evanston, Ill.). Phys. Rev. 119, 623-33(1960) July 15.

Bombardment of quartz or vitreous silica by positive ions produces a surface layer of altered refractive index whose depth and refractive index is found from reflection coefficient measurements at 650, 600, 550, 500, and 450 mμ. The layer depths and the changes in refractive index versus integrated flux are given for H_2^+, D_2^+, He^+, Ne^+, Ar^+, Kr^+, and Xe^+ ions with energies from 7.5 to 59 kev. All bombardments give approximately equal changes in refractive index for a given energy input per unit volume of material as long as the ion energy is low enough so that energy loss by ionization is negligible. The changes produced by ion bombardment are attributed to direct lattice displacements and are shown to be consistent with the known changes produced in quartz and vitreous silica by fast neutron bombardment. Thermal spikes produced by knock-on atoms in quartz and vitreous silica are experimentally shown to be unimportant for knock-on energies near 45 kev. (auth)

22146

FREQUENT REACTIONS OBSERVED IN THE IRRADIATION OF SILICON WITH NEUTRONS. R. H. Rodriguez Pasques (Comisión Nacional de Energía Atómica, Buenos Aires). Publs. com. nacl. energía atómica (Buenos Aires) Ser. quim. 1, No. 8, 81-9(1957). (In Spanish)

Silicon was bombarded with fast neutrons, and some of the resulting products were investigated, Na^{24} and Mg^{28} being identified among them. The former can be produced either by the reaction (n,2p) or (n,He^3), or both. The formation of Na^{24} can be attributed to an (n,αp) process; it is experimentally proved that the neutron capture contribution to the production of the sodium isotope is very poor. Energy computations related to these nuclear reactions are given. (auth)

22147

DEFORMATION OF IRRADIATED FUEL ELEMENTS. Ch. Allain and P. Thomé. Rev. mét. 56, 443-50(1959). (In French)

Under irradiation, a fuel element shows a typical behavior: surface deformations, anisotropic growth, density variations, slow expansion and swelling, bowing, and cracking tendencies. These deformations are analyzed, and the conditions leading to major deformations are underlined. (auth)

22148

DESCRIPTION OF RADIATION SOURCES INSTALLED AT THE FRENCH ATOMIC ENERGY COMMISSARIAT. P. Leveque. p.141-7 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In French)

Four irradiation apparatus installed at the Saclay Nuclear Research Centre are described. The apparatus at the Centre Lyonnais d'Applications atomiques are also described. This apparatus is expected to come into service at the beginning of 1960 and will be on a semi-industrial scale, with a cobalt-60 source of 3,000 curies at first and later of 40,000 curies, and will enable continuous-flow irradiation to be made. (auth)

22149

EFFECT OF GAMMA RADIATION ON POLYETHYL ACRYLATE. H. Heyns and V. Desreux (Univ. of Liège). p.257-62 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In French)

The effect of Co^{60} radiation on polyethylacrylate specimens of different molecular weights was studied in solution and in the solid state. The solvents used were benzene and carbon tetrachloride, and the experiments were performed at ambient temperature with and without the presence of air. No after-effect was noted when the solutions were irradiated. When the diluted solutions were irradiated with increasing doses in the presence of air, a decrease was noted in the intrinsic viscosity and the sedimentation constant. The results could be explained by degradation. The direct and indirect effects were proportional to the dose and varied in different solvents. They were also both directly proportional to the initial molecular weight of the polymer. The influence of oxygen and inhibitors was studied. Specimens were also irradiated in the solid state, and it was found that crosslinking occurred with or without the presence of oxygen, and was accompanied by a varying degree of degradation. Finally, tests made on concentrated solutions in carbon tetrachloride showed some competition between degradation and crosslinking. (auth)

22150

CHEMICAL CHANGES OF METHACRYLAMIDE UNDER THE INFLUENCE OF GAMMA RADIATION. A. Orszagh, T. Achmatowicz, and J. Zurakowska-Orszagh. p.263-72 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The rate of the radiation-initiated polymerization of methacrylamide was studied in vacuo and in air. Measurements of the viscosity, molecular weight, carbon, hydrogen, and nitrogen content as well as unsaturation were carried out. Infrared analysis demonstrated the existence of polymers having a low degree of polymerization. The effect of irradiation of the monomer in air leads to degradation as well as polymerization. (auth)

PHYSICS

General and Miscellaneous

22151 AD-228374

Toronto. Univ. Inst. of Aerophysics.

BULLETIN AND ANNUAL PROGRESS REPORT, 1959. Oct. 1959. 154p.

A summary of the institute's research program is given along with details of progress on research projects such as those on mechanics of rarefied gases, plasmodynamics, non-stationary gasdynamics, supersonic flows, aerodynamic noise, and aerodynamics of VTOL/STOL aircraft. A bulletin containing information for prospective students is included. (J.R.D.)

22152 AD-231571

National Carbon Co. Research Labs., [Cleveland].

THERMOELECTRIC MATERIALS. Bi-monthly Progress Report No. 3 [for] May 28, 1959 to July 28, 1959. N. R. Thielke, comp. Aug. 15, 1959. 39p. Contract NObs 77066.

Research on the thermoelectric properties of carbon and graphite materials, refractory nitrides, alkali metals and their fused halides, and transition metal compounds is reported. In other work, continued investigation of an experimental thermoelectric generator is discussed. (J.R.D.)

22153 AD-231579
David Sarnoff Research Center, Princeton, N. J.
THERMOELECTRIC MATERIALS FOR POWER CONVERSION. Quarterly Progress Report No. 3 Covering the Period August 1, 1959–October 31, 1959. G. D. Cody, J. P. Dismukes, E. F. Hockings, and D. Richman. Edited by F. D. Rosi. Nov. 10, 1959. 24p. Contract NOBS-77057.

Materials research is reported on ternary compounds and alloys which appear promising for thermoelectric applications. Studies on the compound $AgSbTe_2$ included the variation of thermoelectric power with resistivity at 300°K and the dependence of thermoelectric power and resistivity on temperature at 25 to 525°C. An average figure of merit of 1.3×10^{-3}/deg is estimated in this p-type material at 100 to 500°C. Compounds of the type $AgMTe_2$, where M is a transition metal, were prepared, and single-phase material was obtained with the Cr, Mn, Fe, and Co substitutions. These compounds are semiconductors with reasonably high mobilities and resistivities ranging from 1×10^{-2} to 4×10^{-4} ohm-cm. Their low thermoelectric powers suggested degeneracy. The compound Ag_3AuTe_2 was synthesized by solidification from the melt and found to be a p-type semiconductor with a resistivity of 0.55 ohm-cm and a thermoelectric power of 72 μv/deg. Its lattice thermal conductivity was estimated to be 0.0089 W cm^{-1} deg^{-1}. The alloy system $AgSbTe_2$–SnTe was found to exhibit complete solid miscibility. Data were obtained on the variation of thermoelectric power and thermal conductivity with alloying. Solid solution alloys of Bi_2Te_3 with other binary compound semiconductors yielded a figure of merit averaged for n- and p-type material of 1.7×10^{-3}/deg over the temperature range 25 to 250°C. An apparatus is described for rapid measurement of thermoelectric power and resistivity at high temperatures. Fabrication of a junction between molybdenum and an InAs–GaAs alloy which is stable up to 650°C is also reported. (auth)

22154 AD-231650
Union Carbide Corp. Parma Research Lab., Ohio.
THERMOELECTRIC MATERIALS. Bi-Monthly Progress Report No. 4 [for] July 28, 1959 to September 28, 1959. R. G. Breckenridge, comp. Oct. 15, 1959. 36p. Contract NObs-77066.

Research on the thermoelectric properties of carbon and graphite materials, refractory nitrides, and alkali metals and their fused halides is reported. In other work, the crystallography and metallurgy of transition metal compounds were studied and results are included. Programming of the integrals needed in the transport theory of graphite is almost complete. Continued development work on a prototype thermoelectric generator is also reported. (For preceding period see AD-231571.) (J.R.D.)

22155 AD-233237
Stanford Research Inst., Menlo Park, Calif.
INTERACTION OF ELECTRON AND ION BEAMS WITH METASTABLE SUBSTANCES. Quarterly Progress Report No. 3 [for] August 1 to October 31, 1959. Charles J. Cook and William J. Fredericks. Oct. 29, 1959. 10p. Project No. 8-07-02-004. Contract DA-44-009-ENG-3783.

An attempt was made to determine the absorption coefficient for slow electrons on MgO at 1.5 to 5.5 ev. The photoabsorption for alkali halide crystals which was used in electron interaction studies was determined with a view to describing the capture process for electrons by both the deep and shallow traps found in the crystal targets. (See also AD-219784.) (C.J.G.)

22156 AFOSR-TN-59-1302(Suppl.)
California Inst. of Tech., Pasadena. Guggenheim Aeronautical Lab.
MAGNETOHYDRODYNAMIC SIMPLE WAVES. Y. M. Lynn. May 1960. 25p. Contract AF49(638)-476.

An exact analytic simple wave solution for arbitrarily oriented magnetic fields is presented. Computations of integral curves for fast waves are given. (W.D.M.)

22157 AFOSR-TN-60-531
Johns Hopkins Univ., Baltimore.
INCREASED FIELD DEPTH IN TRACK PHOTOGRAPHY BY MEANS OF SPHERICAL ABERRATION. F. Rasetti. May 1960. 4p. Contract AF18(603)-143.

A lens, provided with spherical aberration, was modified by increasing the spacing between the first two and the third elements of the lens. This modification resulted in increased field depth for use in track photography. (C.J.G.)

22158 AFOSR-TR-57-78
Ohio State Univ. Research Foundation, Columbus.
PROCEEDINGS OF THE SYMPOSIUM ON SOLID AND LIQUID HELIUM THREE, HELD AT THE OHIO STATE UNIVERSITY, AUGUST 20-23, 1957. Aug. 1957. 241p Contract AF49(638)-225. (AD-232154).

A volume containing papers read at the Liquid and Solid He^3 Conference is presented. Included are papers on experimental and theoretical aspects of liquid He^3, experimental results on solutions of He^3 in He^4, experiments with solid He^3, theories of isotope mixtures, and model theories. (J.R.D.)

22159 CEA-1445
France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Saclay and Institut "Rudjer Boskovic", Zagreb.
ETUDE DE L'EMISSION SECONDAIRE D'ELECTRONS AU COURS DU BOMBARDEMENT DE CIBLES METALLIQUES PAR DES IONS POSITIFS D^+ ET D_2^+. (Study of the Secondary Electron Emission During Bombardment of Metal Targets by Positive D^+ and D_2^+ Ions). J. Leroy and K. Prelec. 1960. 18p.

The secondary electron yield ($\bar{\gamma}$) due to primary positive ions D^+ and D_2^+ has been measured in the 70 to 300 kev ion energy range. Several metallic targets were used. The variation of this yield with the angle of incidence is proportional to sec θ, where θ is the angle between the beam of primary ions and the normal to the target surface. The $\bar{\gamma}$ values decrease for increasing energy ions. At a given energy all the targets tried gave approximately the same electron yield. (auth)

22160 CX-21
New York Univ., New York. Inst. of Mathematical Sciences.
DISSOCIATIVE RECOMBINATION. Ernest Bauer and Ta-You Wu. Oct. 1955. 27p. Contract AF19(122)-463. (AFCRC-TN-55-865).

The following process is considered. A hydrogen molecular ion H_2^+ in its ground state, $(1s\sigma_g)^2\ \Sigma_g^+$ captures a free electron of low energy, and splits up into two hydrogen atoms. For low energy of the incident electron, the resulting hydrogen atoms will carry off most of the binding energy of the molecular ion as electronic energy of excitation rather than as relative kinetic energy of the nuclei. Two important final states of the atoms are (1s, 2s) and (1s, 2px). The cross section for transitions into these two states are calculated as a function of electron energy for energies less than 1 ev, and are found to be of gas kinetic order of magnitude (10^{-15} cm^2). (auth)

22161 DASA-1161

Illinois. Univ., Urbana.

REPORT ON SURVEY OF LITERATURE IN CONNECTION WITH THE DYNAMIC BEARING CAPACITY OF SOILS. Narbey Khachaturian. Oct. 1959. 27p. R & D Subproject No. 8-12-95-420. Contract DA-22-079-eng-240. (AD-232102).

A critical survey is made of the literature on the structural dynamics of soils. The references are presented in the areas of laboratory dynamic tests on soils, field dynamic tests on soils, design concepts and methods in structural dynamics, and miscellaneous items of information contributing to the soil dynamics. The report contains altogether 114 entries. The important references in each group are discussed briefly. (auth)

22162 EDL-M-234

Sylvania Electric Products Inc. Electronic Defense Lab., Mountain View, Calif.

AN INVESTIGATION OF THE LUNAR ECHO METHOD OF DETERMINING ELECTRON COUNT OF THE ATMOSPHERE. Harold L. Newman. Nov. 13, 1959. 18p. Contract DA 36-039-SC-78281. (AD-233393).

The technique of determining the electron content of the ionosphere by measurement of Faraday rotation of 120-mc lunar echos is examined to determine the limits of applicability of this method. It is shown by numerical integration that provided all the electrons are located within a few hundred kilometers of the F2 layer maximum the method yields useful and essentially unambiguous results. However, it is incapable of detecting the possibly very large number of electrons which are believed to exist at low concentrations (of the order of 1000 per cm^3) in the upper reaches of the earth's atmosphere. Since this number might be greater by a factor of several times that predicted by the method it is concluded that the values of electron count obtained by the Faraday rotation technique are necessarily minimum values, and that other methods must be used to determine the electron count in regions where both the electron density and the earth's magnetic field are highly tenuous. (auth)

22163 HE-150-175

California. Univ., Berkeley. Inst. of Engineering Research.

ON THE SEPARATION PHENOMENON OF BINARY GAS MIXTURE IN AN AXISYMMETRIC JET. Reuben R. Chow. Nov. 4, 1959. 74p. Project No. 35. Contract AT(11-1)-34. OTS.

Some experimental findings are presented on the separation of N_2 and O_2 in an axisymmetric under-expanded jet of air exhausting from a sonic nozzle into a low pressure field of 208 microns of mercury. Concentration and pressure fields were obtained through local surveys in the jet. It was found that the jet core was enriched with O_2. Separation was found increasing downstream; a maximum was observed before the first Mach disc. At various axial stations, radial profiles of the concentration of the O_2-component produced a minimum value at the location of the diffuse shock barrel inside the jet. (auth)

22164 HW-33566(Rev.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE METHOD OF SUCCESSIVE GENERATIONS. G. W. Stuart and R. W. Woodruff. Jan. 17, 1955. Decl. Mar. 31, 1960. 36p. Contract W-31-109-Eng-52. OTS.

Neutron behavior in a solid cylindrical fuel rod was considered by treating each neutron generation separately, assuming a hemispherically symmetric incident neutron distribution. The collision densities per unit time were calculated as a function of cross section and radius for each generation. This permitted calculation of the collision probability of each generation as well as the flux distribution in the rod. The latter allowed an exact calculation of disadvantage factor. Blackness was calculated from the generic collision probabilities. Finally, by a successive generation approach, calculations of various moments of the exit cosine are proposed which will permit a spherical harmonics treatment of neutrons in the moderator, thus permitting calculation of thermal utilization. Tables of factors used in the calculations are included. (auth)

22165 HW-64251

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FLUX MONITORING FOR RADIATION DAMAGE STUDIES. H. H. Yoshikawa. Mar. 3, 1960. 19p. Contract AT(45-1)-1350. OTS.

The procedures involved in the computation of the integrated neutron fluxes in the fast, thermal, and epithermal regions are described. These fluxes are measured by the activation of nickel and cobalt foils during a reactor irradiation. (auth)

22166 LA-2419

Los Alamos Scientific Lab., N. Mex.

IDEAL GAS TREATMENT OF THE EQUILIBRIUM COMPOSITION, ENTHALPY FUNCTION, AND HEAT CAPACITY OF CESIUM VAPOR AND CESIUM PLASMA. David G. Clifton. Mar. 1960. 32p. Contract W-7405-eng-36. OTS.

The equilibrium compositions of cesium vapor, assuming it to consist of the monomer, Cs(g), and the dimer, $Cs_2(g)$, and to behave as an ideal gas mixture, were computed for a wide temperature range at the pressures of 0.0001, 0.001, 0.01, 0.1, 1, 10, 100, 760, and 1000 mm of Hg. The temperatures range from 300°K up to the temperatures at which the concentrations of $Cs_2(g)$ become very small. The enthalpy functions and the heat capacities of the equilibrium mixtures were computed for these same sets of temperatures and pressures. The equilibrium concentrations of Cs(g) and $Cs_2(g)$, the enthalpy functions, and the heat capacities of the equilibrium mixtures also were computed for cesium vapor at the equilibrium vapor pressure of liquid cesium over the temperature range of 350 to 1200°K. Ideal gas conditions were assumed. The equilibrium concentrations of Cs(g), $Cs^+(g)$, and $e^-(g)$, the enthalpy functions, and heat capacities of the equilibrium mixtures of cesium plasma were computed for the temperature range 1500 to 4200°K at pressures of 0.0001, 0.001, 0.01, 0.1, 1, 10, and 100 mm of Hg. The ideal gas laws were assumed. The equilibrium concentrations for the over-all mixture of Cs(g), $Cs_2(g)$, $Cs^+(g)$, $Cs_2^+(g)$, and $e^-(g)$ were computed using an estimated free energy function for $Cs_2^+(g)$. These results are approximate at best. (auth)

22167 LAMS-2413

Los Alamos Scientific Lab., N. Mex.

TABULATED VALUES OF THERMAL DIFFUSION COLUMN SHAPE FACTORS FOR THE LENNARD-JONES (12-6) POTENTIAL. B. B. McInteer and M. J. Reisfeld. Oct. 1959. 56p. Contract W-7405-eng-36. OTS.

The theory of the hot-wire diffusion column involves the shape factors h, k_c, k_d, which are functions of the transport properties of the gas. The shape factors were evaluated numerically for a gas whose molecules interact according to the Lennard-Jones (12-6) potential, given by $V(r) = 4\epsilon[(\sigma/r)^{12} - (\sigma/r)^6]$. (W.D.M.)

22168 LAMS-2428
Los Alamos Scientific Lab., N. Mex.
ANNIHILATION RADIATION COUNTING FOR NEUTRON ACTIVATION DETERMINATION. J. P. Conner and R. T. Wagner. May 18, 1960. 19p. Contract W-7405-Eng-36. OTS.

Scintillation counting methods were used to measure the annihilation of positrons following neutron activation of copper and praseodymium to determine the number of neutrons in a short intense burst. A NaI(Tl) crystal was used to view the annihilation radiation in the 0.511-Mev photopeak, and coincidence methods were used with two NaI(Tl) crystals to reduce background counts. These experiments demonstrate the feasibility of measuring neutron bursts of the order of 10^5 neutrons in a 3-to-5 μsec pulse by annihilation counting techniques. (auth)

22169 NBS-6539
National Bureau of Standards, Washington, D. C.
ANALYSIS OF EXPERIMENTS ON LIGHT RESIDENTIAL STRUCTURES WITH DISTRIBUTED Co^{60} SOURCES. Charles Eisenhauer. Oct. 15, 1959. 94p. NBS Project 0400-40-04400.

The shielding potentialities for γ radiation were analyzed for light residential structures of the following type: two story wood frame house, one story wood rambler, two story brick house, and a precast concrete house. A phantom house, consisting of Al tubing fastened by clamps, was erected to measure dose rates with no intervening attenuating material. The dependence of shielding on source energy and on reversal of source and detector is discussed. The results of the investigation are compared with various calculational schemes for evaluating radiation protection in structures. (C.J.G.)

22170 NP-8814
Naval Research Lab., Washington, D. C.
NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period January–March 1960. Apr. 1, 1960. 28p.

Research progress at NRL in nuclear constituents and structure and nuclear instrumentation and technology is reported. Separate abstracts were prepared for the 7 sections of the report. (See also NP-8086.). (W.D.M.)

22171 NP-8814(p.20-3)
Naval Research Lab., Washington, D. C.
PRELIMINARY INVESTIGATION OF BRILLOUIN FLOW IN INTENSE RELATIVISTIC BEAMS. D. dePackh and P. B. Ulrich.

A theoretical examination of the flow of electrons in the presence of an external magnetic field under isothermal conditions and in equilibrium is considered. The ultimate aim is to analyze, by use of a computer, the distribution of particles, fields, and velocities under widely varying conditions. The results of a preliminary effort are presented, in which the significant dependent variables are expanded in power series in the square of the radial coordinate; a solution through the first order in r^2 is then obtained under assumptions of axial symmetry and uniformity of the external magnetic field. (W.D.M.)

22172 NP-8906
Princeton Univ., N. J.
MOLECULAR PROBLEMS IN HEAT AND MASS TRANSFER: RECOMBINATION OF HYDROGEN ATOMS ON GLASS. Kin Tsu and Michel Boudart. [1960]. 111p. Contract AF49(638)-32.

A kinetic study of the recombination of hydrogen atoms on glass was carried out. At low temperatures, the catalytic rate appears to be limited by the adsorption process on the entire surface. At higher temperatures, it becomes controlled by the surface diffusion of adsorbed atoms to uniformly distributed active sites. At still higher temperatures, reaction takes place directly and exclusively on the active sites. A theory is presented and describes the transition between the kinetic regime and the regime of surface diffusion. The experimental data, characterized by a complicated Arrhenius behavior, are explained by this heretofore unexplored mechanism of heterogeneous catalysis. (auth)

22173 SCTM-39-60(51)
Sandia Corp., Albuquerque, N. Mex.
THE USE OF PRESSURE BARS AND PLATES FOR THE INVESTIGATION OF SHOCK WAVES FROM ELECTRICALLY EXPLODED WIRES. W. J. Halpin and R. E. Hendricks. Feb. 9, 1960. 13p. OTS.

Tests were performed which demonstrated the potential usefulness of the Hopkinson pressure bar and a pressure plate for studying shock waves that proceed from exploding wires. (C.J.G.)

22174 SCTM-268-56(51)
Sandia Corp., Albuquerque, N. Mex.
IBM PROBLEM M CURVES. C. D. Broyles. Dec. 1, 1956. Reprinted June 29, 1960. 58p. OTS.

Working graphs are presented of pressure, density, velocity, and temperature from calculations of a spherically symmetric explosion in a homogeneous atmosphere. (auth)

22175 TID-6154
Purdue Research Foundation, Lafayette, Ind.
BASIC RESEARCH WITH HIGH ENERGY ELECTRONS AND X-RAYS PRODUCED BY A 300 MEV SYNCHROTRON. Annual Progress Report. June 30, 1960. 44p. Contract AT(11-1)-123. OTS.

The operation, performance, and modifications to the 300-Mev synchrotron are reported. A 1-Mev injection system was installed. Measurements of the photoproduction cross sections were made for charged pions from C, H, and deuterium at k_0 values of 186 to 278 with the meson magnetic spectrometer. Excitation curves were measured for π^- and π^+ photoproduction on C^{12}. The cross section for π^+ production from $Al^{27}(\gamma,\pi^+)Mg^{27}$ and the absolute yield of Mg^{27} were determined. A polarimeter to detect protons, measure their energy, and measure the spatial orientation of their spins was designed. (See also AECU-3512.) (C.J.G.)

22176 TID-6206
Michigan. Univ., Ann Arbor.
CALCULATION OF HEAT CAPACITIES AND DERIVED THERMODYNAMIC FUNCTIONS FROM THERMAL DATA WITH AN IBM 704 DIGITAL COMPUTER. Bruce H. Justice. June 1960. 79p. Project No. 5. Contract AT(11-1)-70. OTS.

Data reduction for derivation of exact molal thermodynamic functions from experimental thermal data with an IBM 704 digital computer is summarized. The computations are resolved into operations comprising conversion of potentiometric data to apparent heat capacity of the calorimeter and sample and correction of the apparent heat capacity for curvature, subtraction of the heat capacity of the calorimeter-heater-thermometer assembly, and conversion of the resulting sample (or net) heat capacities in turn to molal values. Computations for generation of the smooth heat capacity-versus-temperature curve which can be used algebraically to derive thermodynamic functions are also included. (J.R.D.)

22177 TID-6262
Michigan State Univ., East Lansing.
INFRARED ABSORPTION WAVELENGTHS FOR SOLID LiH

AND LiD. W. B. Zimmerman and D. J. Montgomery. [1960?]. 4p. Contract [AT(11-1)-400]. OTS.

The infrared absorption spectrum of thin films of lithium hydride made from different proportions of the isotopes Li^6-Li^7 and H^1-H^2 was studied. The results are reported only of natural Li depleted in Li^6 (97% Li^7–3% Li^6) in combination with natural hydrogen (100% H^1) or deuterium (98% H^2). For LiH, the position of the adsorption peak was found to be at 17.0 ± 0.2 μ, and for LiD at 22.14 ± 0.2 μ. The ratio of the two wave-lengths is 1.32 ± 0.02. (W.L.H.)

22178 UCRL-9182

California. Univ., Berkeley. Lawrence Radiation Lab. DISSOCIATION OF MOLECULAR IONS BY ELECTRIC FIELDS (thesis–Part II). John R. Hiskes. May 4, 1960. 66p. Contract W-7495-eng-48. OTS.

The reactions $\pi^- + p \rightarrow \bar{p} + p + n$ and $\pi^- + p \rightarrow \bar{p} + d$ were investigated. The calculations are based on third-order perturbation theory with pseudoscalar coupling between nucleons and pions and with a phenomenological treatment of the nucleon-nucleon interaction in the final state. The final-state interactions of the antinucleon are neglected. Cross sections are given in graphical form for the reactions and for transitions between eigenstates of isotopic spin. The final-state nucleon-nucleon interaction is shown to have a large effect on the cross sections. The cross section for the reaction $\pi^- + p \rightarrow \bar{p} + d$ is found to be relatively large. At an energy of 10 Mev above threshold in the center-of-momentum system the ratio of this cross section to that for $\pi^- + p \rightarrow \bar{p} + p + n$ is about 5 : 1. At an energy of 40 Mev above threshold this ratio has decreased to 1 : 1. The total cross section for the reaction leading to the unbound final state is calculated by assuming a modified Fermi statistical model. At an energy 100 Mev above threshold, this cross section is approximately 0.1 mb. A theoretical expression for the transition amplitude is developed. (auth)

22179 CEA-tr-R-804

EMETTEURS α MINCES À GRANDE SURFACE. (Thin α Emitters with Large Surface). G. A. Korolev and G. E. Kocharov. Translated into French from Pribory i Tekh. Ekspt. No. 5, 108-9(1958). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2957.

22180 JPRS-5021

PHYSICAL INVESTIGATIONS OF GASES BY MEANS OF SHOCK WAVES. R. I. Solukhin (Soloukhin). Translated from Uspekhi Fiz. Nauk. 68, 513-28(1959). 29p. OTS.

Methods of using shock waves to investigate the physical and physicochemical properties of different gases at high temperatures are discussed. The propagation of shock waves in a relaxing gas is considered. The initiation of chemical reactions with positive heat effect by high-intensity shock waves and the study of such reactions by means of shock waves are discussed. The state of the gas and thermodynamic equilibrium of the ionized gas behind a shock wave are described. (C.J.G.)

22181 NP-tr-470

PROBLEMS IN THE EXPERIMENTAL DETERMINATION OF PARTICLE SIZE AND IN THE ROSIN, RAMMLER AND SPERLING GRAPHIC REPRESENTATION OF PARTICLE SIZE DISTRIBUTION. W. Fritz. Translated by R. Todd (U.K.A.E.A. Atomic Energy Research Establishment) from Chemiker-Ztg. 83, 819-23(1959). 26p. JCL.

In the characterization of aggregates, particle size distribution is of great importance; the most important analytical methods available for its determination are briefly described, and the magnitude of the possible errors and effects involved in the analysis are discussed. The frequently used Rosin, Rammler, and Sperling graphic representation of particle size distribution is considered from a critical standpoint. (auth)

22182

METHODS TO IMPROVE THE DEVELOPMENT CHARACTERISTICS OF THICK EMULSIONS (400 μ). M. Nicolae. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 371-81(1960). (In Rumanian)

A method for the development of 400-μ films, which satisfies as well as possible the conditions demanded by the recording of high-energy particles, is presented. The experiments were made with NIKFI R films glued to glass 16 to 20 hours before development. The film stacks were irradiated by a beam of relativistic particles at angles from 2 to 5°. The grain density at the ionization minimum, the development gradient, and the clouding density were measured. It was found that during the development by the two temperature method, there is an optimum length of immersion in the developer, corresponding to the minimum value of the development gradient in the depth of the layer. For 400-μ NIKFI R, the optimum immersion is 2.5 hr. By decreasing the pH of the developer in the region from 7 to 6, or by the addition of KBr to the developer, the uniformity of the depth development is slightly improved, but it is at the price of a definite decrease of the development intensity. By varying the temperature of the cold stage from 30 to 20°C, no definite variation of the development gradient was observed. At the low temperatures of the cold stage (20°C), where this stage is long, the dichronic cloudiness is increased. The best results, with respect to the realization of satisfactory development characteristics, were obtained by utilizing the two-temperature method with immersion in the cold developer in two steps. The length of the first bath in a very active developer is equal to its optimum value. The second bath, of shorter duration and in a less active developer, has the aim of assuring the formation in the depths of the film of an activity gradient of the developer of an opposite sign to that formed during the first step. (tr-auth)

22183

THREE-TERM HYLLERAAS-FUNCTION ATOMIC SCATTERING FACTORS FOR THE TWO-ELECTRON IONS. R. P. Hurst (Univ. of Texas, Austin). Acta Cryst. 13, 634-8(1960) Aug. (In English)

The three-term Hylleraas function $\psi = [1 + c_1 u + c_2 t^2] \exp(-\alpha s)$ is used to determine the atomic scattering factors for the helium-like ions. Though some systematic differences are noted, previous self-consistent field and radially correlated factors are found to be in good agreement with present results. It is found that the radial correlation introduced by use of the so-called open shell approximation tends to slightly overemphasize the correlation effect. When one introduces angular correlation as well, the shift in the radial distribution is slightly reduced. Finally, it is noted that the scattering factors from the Hylleraas function tend to be smaller than those computed from hydrogenic charge distributions (hydrogenic charge distribution with a scale factor) at small Bragg angles and larger at the large Bragg angles. An explanation for this latter effect is given. (auth)

22184

STATISTICS OF COUNTING RADIOACTIVE DECAY. Vladimir Matousek. Aplikace mat. (Prague) 4, No. 1, 53-74(1959). (Translated from Referat. Zhur. Fiz. No. 11, 1959, abstract No. 24341).

For conditions that are as close as possible to conditions of real measurements, distribution laws are derived for the times of mathematical expectation, specified number of pulses, and the number of pulses observed in a given time interval. It is shown that the general binomial Poisson law is the most convenient for the derivation of simple asymptotic time distributions. A detailed analysis is made of the influence of the resolution of the measuring setup on the form of the distribution. For the case of practical interest, that of primary Poisson process and constant value of the depth time of the setup, detailed formulas are given for the number of observed pulses and for the expectation times.

22185

STABILITY OF A HOMOGENEOUS BOILING-WATER NUCLEAR REACTOR. B. V. Ershler, B. Z. Torlin, and L. Ya. Suvorov. Atomnaya Energ. 9, 5-9(1960) July. (In Russian)

Equations of homogeneous boiling reactor kinetics are developed with considerations for hydrodynamic boiling mechanisms. Parameters describing reactor performance and oscillations caused by stability disturbances are discussed as well as the influence of certain factors on the stability. (tr-auth)

22186

SCATTERING PROBLEM FOR NON-STATIONARY PERTURBATION. L. P. Nizhnik (Inst. of Mathematics, Academy of Sciences, Ukrainian SSR). Doklady Akad. Nauk S.S.S.R. 132, 40-3(1960) May 1. (In Russian)

It is shown that under given conditions of smoothness and ebbing into infinity, the function c(x,t) has only one solution for plane wave scattering. The problem of reducing the functions c(x,t) according to scattering data is also discussed. (R.V.J.)

22187

THE MEASUREMENT OF THE DEPENDENCE OF THE HALL EFFECT IN n-GERMANIUM ON PRESSURE UP TO 10,000 kg/cm^2. A. I. Likhter and T. S. D'yakonova. Fiz. Tverdogo Tela 1, 95-103(1959) Jan. (In Russian)

The dependence of the Hall effect and the resistivity on pressure is measured up to 10,000 kg/cm^2 at temperatures ranging from −70° to 100°C in n-Ge and Sb alloys, using a small compact apparatus. In the temperature interval where the resistance of the samples increases with temperature, the emf of the Hall effect decreases with pressure; where there is a transition to internal conduction and the resistance decreases with increasing temperature, the emf of the Hall effect increases with pressure. (TTT)

22188

THE INFRA-RED ABSORPTION SPECTRUM DUE TO MINOR CURRENT CARRIERS IN GERMANIUM. Yu. I. Ukhanov (Budennyi Military Red Banner Academy of Communications, USSR). Fiz. Tverdogo Tela 1, 363-7(1959) Mar. (In Russian)

The absorption spectrum due to minor current carriers in germanium was studied in the range 2 to 13 μ at room temperatures and at 105°K. At room temperatures two weak maxima were observed at 3.4 and 4.7 μ. At wavelengths longer than 5.5 μ, the absorption increased sharply and became constant in the range 9 to 13 μ. At 105°K, instead of 2 maxima there was one sharp maximum at 4 μ, where the absorption was comparable with that observed at room temperatures. From 6 μ the absorption increased smoothly, reaching a maximum at 12 μ, the value of which was close to that at room temperatures. It was established that the absorption due to minor current carriers in n-Ge agreed with the absorption spectrum due to basic carriers in p-Ge. (TTT)

22189

CORRELATION BETWEEN THE CAPTURE CROSS SECTION RATIO AND THE POSITION OF ENERGY LEVELS OF THE RECOMBINATION OF SURFACE CENTERS IN GERMANIUM. A. V. Rzhanov. Fiz. Tverdogo Tela 1, 522-4(1959) Mar. (In Russian)

The dependence of the ratio of the effective capture cross section for the vacancy and the electron versus the energy of the recombining level was plotted on a semilogarithmic scale, using both original data and results from the literature (A. Many and D. Gerlich, Phys. Review 107, 404(1957); E. O. Johnson, Ibid. 111, 153(1958)). A straight linear correlation was found; this is explained by assuming various charge states of the surface centers of recombination. (TTT)

22190

THE DEPENDENCE OF THE LIFETIME OF ELECTRONS AND HOLES IN GERMANIUM UPON THEIR CONCENTRATIONS. V. G. Alekseeva, I. V. Karpova, and S. G. Kalashnikov (Inst. of Radiotechnology and Electronics, Moscow). Fiz. Tverdogo Tela 1, 529-34(1959) Apr. (In Russian)

The dependence of the lifetime of electrons and holes upon their concentration was measured for the addition of two impurity elements—phosphorus for n-type germanium and boron for p-type germanium. The photomagnetoelectric effect method gave a lifetime of 50 microsec at a concentration of 10^{17} cm^{-3} for phosphorus and a lifetime of 60 microsec for boron at the same concentration. Below this concentration the coefficient of recombination does not depend upon the concentration and the process of shock recombination does not play a noticeable role. (TTT)

22191

THE INFLUENCE OF TEMPERATURE ON THE RECOMBINATION RATE OF ELECTRONS AND HOLES ON COPPER ATOM IN GERMANIUM. N. G. Zhdanova, S. G. Kalashnikov, and A. I. Morozov (Inst. of Radiotechnology and Electronics, Moscow). Fiz. Tverdogo Tela 1, 535-44(1959) Apr. (In Russian)

The lifetime was calculated from measurements of the diffusion length and a knowledge of the coefficient for hole diffusion. The impurities in germanium were phosphorus and antimony with electron equivalent concentrations from 3.5×10^{14} to 6×10^{16} cm^{-3}. The results show that for high impurity levels the lifetime and therefore the cross section for capture depends weakly on temperature; for low impurity levels, the lifetime depends strongly on temperature. The cross section for hole capture for triply charged copper ions is larger than for doubly charged ions, and the temperature dependence of the lifetime is in good agreement with the theory of recombination on many-charged centers. (TTT)

22192

THE RECOMBINATION OF ELECTRONS AND HOLES ON NICKEL ATOMS IN GERMANIUM. S. G. Kalashnikov and K. P. Tissen (Moscow State Univ.). Fiz. Tverdogo Tela 1, 545-52(1959) Apr. (In Russian)

The influence of temperature upon the lifetime of electrons in p-type germanium containing nickel was measured for different hole concentrations. The coefficients for electron capture into the upper and lower energy levels of nickel do not depend on temperature and the ratio of the coefficients is 6 to 1. The coefficient for capture also does

not depend upon the concentration of holes. This lack of dependence of lifetime on temperature and on the concentration of holes is in good agreement with the theory for statistical recombination on traps having two energy levels. The lower energy level of nickel lies 0.17 ev above the valence bands. (TTT)

22193

ON THE REFLECTION COEFFICIENT FOR CLARIFIED SURFACES OF SILICON PHOTOCELLS. V. M. Malovetskaya, V. S. Vavilov, and G. N. Galkin (Levedev Inst. of Physics, Moscow). Fiz. Tverdogo Tela 1, 1201-4(1959) Aug. (In Russian)

The sensitivity of silicon photocells to solar radiation can be increased by lowering the silicon surface reflection. This is accomplished by coating the surface with a film possessing certain optical properties which cause the interference between light reflected from the film and that reflected from material under the film. It was found that SiO_2 would satisfy these optical properties, would be stable against temperature fluctuations, and, because the silicon surface can be oxidized directly, would not introduce impurities that could destroy the semiconducting properties of the silicon. Reflection can be lowered to 7% as compared to 30% for pure silicon. Film thickness can be varied to change this reflection minimum from one part of the light spectrum to another. The photocell current is raised by 20 to 25% using SiO_2 films. It is found that after half a year the film properties are unchanged. (TTT)

22194

TEMPERATURE DEPENDENCE OF THE ELECTRON CAPTURE COEFFICIENT OF THE MEDIUM LEVEL OF COPPER IN GERMANIUM. S. G. Kalashnikov and A. I. Morozov (Inst. for Radiotechnology and Electronics, Moscow). Fiz. Tverdogo Tela 1, 1294-6(1959) Aug. (In Russian)

The temperature dependence of the electron capture coefficient, C_{n2}, is investigated by studying the temperature dependence of the electron lifetime, τ, in samples of germanium with varying amounts of copper. The lifetime and the coefficient are related by the expression, $\tau = (NC_{n2})^{-1}$, where N is the copper concentration in germanium. The electron lifetime is determined by: the simultaneous measurements of the photomagnetoelectric effect and of the photoconductivity, and the method of stationary photoconductivity. Results show that C_{n2} slowly increases with decreasing temperature while the capture cross section, S_{n2}, is a function of T^{-2}, where T is the absolute temperature. (TTT)

22195

INVESTIGATION OF INTERACTION OF HOLES IN P TYPE GERMANIUM WITH ACOUSTIC OSCILLATIONS. I. V. Mochan, Yu. N. Obraztsov, and T. V. Smirnova (Inst. of Semiconductors, Academy of Sciences, Leningrad). Fiz. Tverdogo Tela 1, 1351-9(1959) Sept. (In Russian)

The temperature dependence of the mean free flight time of phonons interacting with holes in p-Ge was measured. Comparison of experimental values of $\left(\frac{\Delta a\varphi}{H^2}\right)_{H=0}$ and the mean free flight time of the interacting holes, τ_e, gave $\tau\varphi \sim T^{-2.7}$, where $\Delta a\varphi$ is the change in the phonon part of the thermoelectromotive force ($a\varphi$) due to the application of a weak magnetic field, H. Four specimens of p-Ge cut in the [100], [111], [011], and [110] directions and one specimen of n-Ge cut in the [110] direction were used. A short description and sketch of the apparatus is included. The results are:

Measured quantity	Range of Temperatures °K	Type of Ge	Temperature dependence
$a\varphi$	100–200	p	$T^{-2.2}$
$a\varphi$	100–200	n	$T^{-2.2}$
$\left(\frac{\Delta a\varphi}{H^2}\right)_{H=0}$	100–200	p	$T^{-2.0}$ to $T^{-2.4}$

The results are comparable with other results from the literature. (TTT)

22196

ON THE NATURE OF THE SURFACE RECOMBINATION CENTERS IN GERMANIUM. A. V. Rzhanov, Yu. F. Novototskiĭ-Vlasov, and I. G. Neizvestnyi (Inst. of Semiconductors, Academy of Sciences, Leningrad). Fiz. Tverdogo Tela 1, 1471-4(1959) Sept. (In Russian)

Photoconductivity measurements were used to determine the temperature dependence of the surface recombination velocity. An Arrhenius plot of the maximum rate was linear below 400°K and tended to a constant at higher temperatures. From this, the activation energy was determined to be 0.2 ev and the limiting concentration of centers 10^{12} cm^{-2}. In order to explain the observed dependence of surface recombination velocity as a function of temperature, two systems of recombination centers with different capture cross sections were postulated. One type of center is considered due to structural defects from etching the surface of the Ge, and the other is this center modified by absorbed water molecules near the defect. (TTT)

22197

ON THE POSSIBILITY OF MAKING AN OHMIC CONTACT ON A SILICON SEMICONDUCTOR BY RUBBING IN A METAL. I. D. Kirvalidize and V. F. Zhukov. Fiz. Tverdogo Tela 1, 1583-6(1959) Oct. (In Russian)

A method of producing an ohmic contact between n or p type silicon semiconductors and a tungsten wire is presented. Instead of abrading the silicon in order to produce a "disturbed layer" at the junction, the silicon was etched for a few minutes with a 10% solution of KOH at approximately 100°C and then contacted with a rotating disk of one of the following metals: Mo, Fe, brass, Sn, Ta, bronze, Ni, Cu, and Al. For comparison, junctions ground instead of etched before the friction process were also investigated. Of the metals tested Al and Ni produced ohmic contacts as good with the etching as with the abrasion. A proposed explanation for the good ohmic contact caused by rubbing in a metal on an etched surface is that high temperatures produced locally during the rubbing in cause diffusion of the metal into the semiconductor, and metal oxides are formed which act as abrasive particles. Voltage-current characteristics and two photomicrographs are included. (TTT)

22198

THE DEPENDENCE OF THE HALL COEFFICIENT ON THE MAGNETIC FIELD INTENSITY IN SILICON. N. S. Orlova and V. M. Tuchkevich (Inst. of Physics and Tech., Academy of Sciences, USSR). Fiz. Tverdogo Tela 1, 1631-4(1959) Oct. (In Russian)

The Hall coefficient, R, was measured in two n-type and 5 p-type silicon semiconductors. Measurements were taken at 114°, 136°, and 300°K for all samples. The relative variation, R/R_{max} of the Hall coefficient was independent of temperature and reached a constant value for a magnetic field of 1.0 to 1.2×10^4 gauss. For magnetic fields between 100 and 9.0×10^3 gauss the Hall coefficient increased linearly; also n- and p-type silicon had the same type of dependence on field, in contrast to n- and p-type germanium. (TTT)

22199

ENERGY BARRIER BETWEEN SLOW SURFACE TRAPS AND VOLUME IN GERMANIUM AND SILICON. I. I. Abkevitch (Gersten Pedagogical Inst., Leningrad). Fiz. Tverdogo Tela 1, 1676-8(1959) Nov. (In Russian)

The quantum yield is measured as a function of the contact potential for 1.5, 3, and 10 ohm-cm single crystal Ge, and 1 ohm−cm, Si, irradiated with various frequencies of monochromatized light. A break in the curve of the quantum yields vs. energy at 3.15 to 3.45 ev is interpreted as the barrier height for the transition of electrons from the volume of the crystal to the surface traps. A tunneling mechanism is proposed for the transition. The thickness of the barrier varies for different samples of germanium and silicon from 5.8 to 8A. This value is much smaller than the thickness of the oxide layer. (TTT)

22200

CAPTURE CROSS SECTIONS FOR ELECTRONS AND HOLES BY NICKEL ATOMS IN GERMANIUM. S. G. Kalashnikov and K. P. Tissen (Moscow State Univ.). Fiz. Tverdogo Tela 1, 1754-7(1959) Nov. (In Russian)

Recombination on nickel atoms for n-type germanium was measured, and the absolute cross section for the capture of electrons and holes by nickel atoms in germanium was determined. From the measurement of the temperature dependence of the Hall constant, two acceptor levels for nickel in germanium were found; one 0.22 ev above the valence band and the second 0.30 ev below the conduction band. The cross section for the capture of holes by the upper level is $\sim 2 \times 10^{-14}$ cm^2, and for the capture of electrons by the upper and lower level is 2.7×10^{-16} cm^2, and 2×10^{-15} cm^2, respectively. These cross sections are practically independent of the concentration of charge carriers and temperature. (TTT)

22201

THE DETERMINATION OF THE RATIO OF ELECTRON AND HOLE CAPTURE CROSS SECTIONS BY COPPER ATOMS IN GERMANIUM. K. Konstantinesku (Moscow State Univ.). Fiz. Tverdogo Tela 1, 1766-8(1959) Nov. (In Russian)

A method for the determination of the ratio of capture cross sections of electrons and holes, which employs the measurement of the temperature and electron and hole concentrations at which the lifetime of excess electrons and holes does not depend on their concentration, was applied to the case of copper atoms in germanium. Results are given for p-type germanium with hole concentrations from 0.78×10^{-15} cm^{-3} to 5.2×10^{-15} cm^{-3}, and for n-type germanium with electron concentrations from 1.1×10^{-14} cm^{-3} to 2.5×10^{-14} cm^{-3}. The ratio of hole to electron capture in the former varies from 8 to 13, and in the latter from 400 to 100. Since the energy levels used in the determination of these ratios are but poorly known, these results should be regarded as order-of-magnitude values only. (TTT)

22202

A NEW INTERMETALLIC SEMICONDUCTOR COMPOUND. Ya. A. Ugaĭ and T. N. Vigutova (Voronezh State Univ., USSR). Fiz. Tverdogo Tela 1, 1786-8(1959) Dec. (In Russian)

On the basis of theoretical considerations, the intermetallic compound Na_4Sb_4 is expected to have semiconducting properties. For preparing this material, the pure metals were heated in a N_2 atmosphere to 650°C for 30 min, then cooled slowly with the furnace door closed. Although the new compound has a color similar to that of Sb, its structure is quite different, forming fan-shaped crystals. The microhardness of the compound was found to be 114.5 kg/cm^2 and its specific conductivity at 20°C was 2.1 ohm^{-1} cm^{-1}, increasing with increasing temperature. From the temperature dependence of the conductivity the width of the forbidden zone was calculated to be 0.82 ev which is in agreement with the accepted correlation between the chemical bond and the semiconducting nature of the compound. (TTT)

22203

INFLUENCE OF CRYSTAL DEFORMATIONS ON THE ELECTRICAL PROPERTIES OF p-GERMANIUM AND SILICON. G. E. Pikus and G. L. Bir (Inst. of Semiconductors, Academy of Sciences, Leningrad). Fiz. Tverdogo Tela 1, 1828-40(1959) Dec. (In Russian)

On the basis of an expression for the energy spectrum of the "holes," derived previously by the authors (This Journal, 1, 1642-58(1959)) for a deformed lattice similar to that of Ge, approximate formulas are presented for calculating the conductivity changes, the Hall effect, and the resistance in a weak magnetic field, stipulating that the only change in the crystal caused by deformations is a change in the energy of the holes. (TTT)

22204

HIGH-FREQUENCY PROPERTIES OF YTTRIUM AND LUTETIUM FERRITES WITH A GARNET-LIKE STRUCTURE. A. G. Gurevich, I. E. Gubler, and A. P. Safant'evskiĭ (Inst. of Semiconductors, Academy of Sciences, Leningrad). Fiz. Tverdogo Tela 1, 1862-5(1959) Dec. (In Russian)

The width of the magnetic resonance peaks ($2\Delta H$) for samples of $Y_3Fe_5O_{12}$ and $Lu_3Fe_5O_{12}$ prepared in various ways (including the addition of small amounts of Cu and Mn impurities) were measured as a function of the relative density (η). It is found that all of the data can be correlated with the following equation: $2\Delta H = (2\Delta H)_{100\%} + 4\pi M_0(1-\eta)$, where M_0 is the magnetic saturation (about 135 gauss) and $(2\Delta H)_{100\%} \cong 40$ gauss. The components of the magnetic permeability tensor μ and the electric permeability $e = e' + je''$ are measured for $Y_3Fe_5O_{12}$ at frequencies corresponding to wavelengths $\lambda = 3.2$, 10, and 50 cm, as a function of the strength of the magnetic field H_0. At $\lambda = 3.2$ cm there is no "natural" resonance (at $H_0 = 0$), but at $\lambda = 10$ cm, a natural resonance appears. To have small electric losses it is desirable to have a high density and a low value of e''. This can be done either by adding 1 to 2% Mn^{4+} or by adding a small amount of Cu and lowering the annealing temperature to 1200°C. It is felt that the values of μ and e for $Lu_3Fe_5O_{12}$ should be similar to those for $Y_3Fe_5O_{12}$. (TTT)

22205

METHOD OF LOCAL FUNCTIONS FOR THE PROBLEM OF ONE DIMENSIONAL SCATTERING. Hoang Xuan Han (Société Alsthom, Paris). Inds. atomiques 4, No. 5-6, 49-54(1960). (In French)

In theory the problem of scattering in n groups and for several regions is solved by the matrix method, and the numerical results are obtained by automatic calculations. However, difficulties arise from subtraction of quantities which are too large and close. Even for the very simple case, the results are not precise. A method is presented which can overcome these difficulties by the use of surfaces of the regions. These functions are called local flux functions. The method is easy to manage for the one- and two-group theory. It is described in detail for one and two groups. The method is then generalized, but material difficulties limit it to the three-group theory. (J.S.R.)

22206

SHOCK WAVES IN MAGNETOHYDRODYNAMICS. M. N. Kogan. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Mekh. i Mashinostr. No. 3, 143-6(1960) May-June. (In Russian)

Flow conditions described by A. I. Akhiezev, G. Ya. Lyubarskiĭ, and R. V. Polovin (Zhur. Eksptl. i Teoret. Fiz. 35, 731-7(1958)) and in previous publications of the author on this subject were further developed, deriving the condition which satisfies the stability requirement. Of the 3 possible types of fast magnetohydrodynamic shock waves only one was found to be stable, contradicting previous opinions that fast shock waves are always stable. Weak shock waves, the parameters of which are only slightly influenced by a small change of the current in the wave, remain stable at Mach numbers lower and higher than 1. (TTT)

22207

EXPERIMENTAL STUDIES OF DIRECTED GAS FLOW IN PULSE DISCHARGE. S. R. Kholev and L. I. Krestnikova (Moscow State Univ.). Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz. No. 1, 29-37(1960). (In Russian)

The properties of supersonic (2 to 10 km/sec) gas flow and shock waves which appear in pulse discharge in a cylindrical chamber are studied, considering the initial pressure, type of gas, and discharge parameters. (R.V.J.)

22208

INVESTIGATIONS OF PULSE DISCHARGE AT LOW PRESSURE BY PROBE METHOD. B. N. Gul'ko (Novo Siberian Electrotechnical Inst., USSR). Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz. No. 1, 197-202(1960). (In Russian)

The pulse discharge in argon was studied by a probe method, and electron temperature, electron concentrations, and space charge were determined. Electron temperature and concentration plotted as functions of pressure and current describe the processes taking place in the discharge. (R.V.J.)

22209

APPLICATION OF EHRENFEST EQUATIONS TO LIQUID-VAPOR AND LIQUID-SOLID MIXTURES OF He^4. O. V. Lounasmaa (Argonne National Lab., Ill.). J. Chem. Phys. 33, 443-5(1960) Aug.

Ehrenfest equations for the constant-volume phase transitions from the mixed liquid-vapor or liquid-solid system to pure liquid or vapor were derived and applied in the case of He^4. Such processes serve as a model of second-order phase transitions. The reasonably good agreement found indicates that these equations may be used to check experimental data at the boundaries of two-phase regions and to determine unknown quantities entering into them. (auth)

22210

INTERACTION OF CONDENSABLE GASES WITH COLD SURFACES. G. W. Sears and J. W. Cahn (General Electric Research Lab., Schenectady, N. Y.). J. Chem. Phys. 33, 494-9(1960) Aug.

Deposition from a molecular beam onto a cold target surface only occurs when the beam pressure is many orders of magnitude larger than the vapor pressure of the depositing phase at the substrate temperature. The critical beam pressure for deposition is interpreted as a critical supersaturation for heterogeneous nucleation of a condensed phase. It is shown that the critical beam pressure is much too large to be accounted for as a critical value for nucleation if the adsorbate temperature and the substrate temperature are alike. The interpretation of critical deposition phenomena as a nucleation event must include the additional assumption that the adsorbate temperature is somewhat higher than the substrate temperature. (auth)

22211

EMISSION SPECTRA OF ERBIUM IN THE SCHEELITE STRUCTURE. L. V. Van Uitert and R. R. Soden (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Chem. Phys. 33, 567-70(1960) Aug.

Erbium exhibits luminescent emission from excited states at 15,300, 18,400, and 24,500 cm^{-1} in calcium tungstate at room temperature and at 77°K. At room temperature, emission from thermally excited states at 18,830, 19,080, and 19,200 cm^{-1} is also prominent. At high erbium concentrations, the above spectra are essentially quenched at room temperature and new spectral lines which appear to originate from electronic levels just below the 18,400- and 24,500-cm^{-1} states are seen. However, at 77°K emission from the 15,300, 18,400- and 24,500 cm^{-1} states is again strong and emission associated with levels just below these is no longer observed. There is no evidence of exchange coupling preferentially quenching the higher-energy emission states as in the cases of Tb^{3+} and Eu^{3+}. This and the temperature dependencies observed suggest that thermal coupling to the lattice is the main factor responsible for quenching the emission of $Na_{0.5}Er_{0.5}WO_4$. (auth)

22212

TOTAL COLLISION CROSS SECTIONS FOR THE INTERACTION OF MOLECULAR BEAMS OF CESIUM CHLORIDE WITH GASES. INFLUENCE OF THE DIPOLE-DIPOLE FORCE UPON THE SCATTERING. Hugo Schumacher, Richard B. Bernstein, and Erhard W. Rothe (Univ. of Michigan, Ann Arbor). J. Chem. Phys. 33, 584-90(1960) Aug.

Total cross sections (Q) for the interaction of beams of CsCl with a number of molecules were measured using an apparatus of ca 4′ angular resolution in which the temperature of the scattering gas could be varied from 200 to 735°K. The temperature dependence of Q was studied for Ar, CH_4, CH_2F_2, CHF_3, CF_4, NO, H_2S, NH_3, and for cis- and trans-CHCl = CHCl. Relative values of Q at 300°K were measured for eight additional gases. The data were correlated using the Massey-Mohr theory, assuming an intermolecular potential $V(r) = -C/r^6$, so that $Q = b(C/v_r)^{2/5}$, where v_r is the relative velocity and b a known constant; the potential constant C was estimated from formulas for the dispersion, dipole-induced dipole, and dipole-dipole forces. For the nonpolar gases the observed small temperature dependence of Q agrees within experimental error (±3%) with that expected from the temperature dependence of v_r. The theoretical values of Q differ by a nearly constant factor from the experimental results; thus relative cross sections are predicted with fair accuracy. For the polar gases the Q's are large, decreasing significantly with increasing temperature. Because of the large dipole-dipole interaction, the approximate theoretical treatment (based on the limiting temperature-dependent dipole-dipole contribution to (C) accounts only semiquantitatively for the observations. (auth)

22213

THE EFFECT OF TURBULENCE AND MAGNETIC FIELD ON ELECTRON DENSITY FLUCTUATIONS IN THE IONOSPHERE. I. D. Howells (Cambridge Univ., Eng.). J. Fluid Mech. 8, 545-64(1960) Aug.

Dungey (1956) has shown that the number densities of electrons and positive ions, under the action of turbulence

and the magnetic field in the ionosphere, are closely equal. Dungey's model and results are used with a single equation for electron density to investigate the possible spectra of fluctuations. It is concluded that, in the circumstances that commonly arise, the spectrum on this model should be nearly isotropic, though exceptionally there could be a strong elongation of irregularities at right angles to the magnetic field. Thus some other mechanism is required to account for the elongation that is observed parallel to the field. Below 110 km, where the magnetic effect on the ions' motion is small, and at wave-numbers in the inertial subrange of the turbulence, dimensional argument shows that the spectrum function (integrated over all directions) is proportional partly to κ^{-1} and partly to $\kappa^{-\frac{5}{3}}$. Above 120 km the magnetic effect is large; a more detailed study shows that when turbulence is present, which probably is not often, the spectrum function in the inertial subrange is proportional to $\kappa^{-\frac{5}{3}}$, with considerable anisotropy. (auth)

22214

PHOTOVOLTAIC EFFECT PRODUCED IN SILICON SOLAR CELLS BY X- AND GAMMA RAYS. Karl Scharf. J. Research Natl. Bur. Standards 64A, 297-307(1960) July-Aug.

The open-circuit voltage and photocurrent produced in a silicon solar cell by x and gamma rays were measured as a function of exposure dose rate, cell temperature, angle of incidence of radiation, and photon energy. This photoresponse was stable and proportional to the exposure dose rate, which was applied up to a maximum of 1.8×10^6 r/hr for x rays and 4×10^2 r/hr for Co^{60} gamma rays. At an exposure dose rate of 1 roentgen per minute the response was of the order of 10^{-5} volt for the open-circuit voltage and 10^{-8} ampere for the photocurrent. At high exposure dose rates of Co^{60} gamma rays, radiation damage became apparent. The temperature dependence of the photoresponse was controlled by the temperature dependence of the cell resistance. The directional dependence of the photoresponse varied with the quality of radiation and for Co^{60} gamma rays was very small for angles from 0 to 70°. The photoresponse decreased with increasing photon energy but changed only little between 200 and 1,250 kilo electron volts. The ratio of the response to x rays of 38 kilo electron volts effective energy and that to Co^{60} gamma rays was approximately 6:1. An approximate value of the thickness of the effective p–n junction layer is deduced from the energy dependence. (auth)

22215

APPLICATION OF NEUTRON DIFFRACTION TO THE PROBLEMS OF SOLID STATE PHYSICS. Gernot Lutz (Institut für Kristallographie, Munich). Kerntechnik 2, 228-31 (1960) July-Aug. (In German)

The possibility of using neutrons in a manner similar to x radiation for the investigation of the structure of solid bodies lies in the dualistic nature of matter required by quantum theory. Corpuscular radiation, in this case neutron radiation, also has wave characteristics. These wave properties in the passage of neutrons through solids can give diffraction and interference phenomena from which the structure of the irradiated material can be deduced. (tr-auth)

22216

INTERMOLECULAR FORCES FROM DIFFUSION AND THERMAL DIFFUSION MEASUREMENTS. S. Weissman, S. C. Saxena, and E. A. Mason (Univ. of Maryland, College Park). Phys. Fluids 3, 510-18(1960) July-Aug.

Experimental values of the diffusion coefficient and the thermal diffusion factor for the systems He-Ar, He-CO_2, and H_2-CO_2, over a temperature range of about −78° to 325°C, were analyzed for the purpose of testing the Lennard-Jones (12–6) and the exp-6 intermolecular potentials, as well as the combination rules usually used in conjunction with these potentials. The exp-6 potential gave excellent results for He-Ar, but the 12–6 potential was not satisfactory. This system afforded no opportunity to choose between the various combination rules. The 12–6 potential worked fairly well for He-CO_2 and H_2CO_2. On the whole, the combination rules were surprisingly good. The importance of considering the higher theoretical approximations for the thermal diffusion factor was emphasized. An expression interrelating the transport properties and independent of any particular intermolecular potential was proposed, which could be used to test how well a mixture conformed to the basic assumptions of the Chapman-Enskog theory or to indicate the consistency of the experimental measurements. (auth)

22217

ANALYSIS OF STEADY-STATE SUPPORTED ONE-DIMENSIONAL DETONATIONS AND SHOCKS. W. W. Wood (Los Alamos Scientific Lab., N. Mex.) and Z. W. Salsburg. Phys. Fluids 3, 549-66(1960) July-Aug.

Consideration was given to the possible steady one-dimensional flows which can occur in a medium in which an arbitrary number of chemical reactions proceed behind an initiating shock. Stability of solutions to the chemical rate equations was also investigated. The theoretical apparatus was that of irreversible thermodynamics and nonlinear mechanics, with neglect of transport processes. Most of the discussion was concerned with detonations, but the analysis could apply to all such reacting systems. For detonations, it was shown that under suitable conditions on the rate functions, there were stable solutions resulting in an equilibrium final state for detonation velocities equal to or greater than the "equilibrium Chapman-Jouguet (C-J)" value corresponding to tangency of the Rayleigh line and the equilibrium Hugoniot. The final state in such a flow was the high-pressure intersection of the Rayleigh line and the equilibrium Hugoniot. These solutions could correspond to piston-supported detonations after decay of initiation transients, and the equilibrium C-J detonation was considered stable with respect to removal of the piston support at sufficiently late times. The "normal frozen C-J condition," corresponding to attainment of chemical equilibrium at a point where the flow velocity was sonic with respect to the "frozen" or high frequency sound speed, was shown to result in an unstable solution. Solutions corresponding to "pathological detonations," in which the region of steady flow terminated at a point of incomplete reaction, were identified, but the conditions necessary or sufficient for their realization were not obtained nor the nature of the subsequent time-dependent flow elucidated. Thus their physical significance remained somewhat doubtful. (auth)

22218

FLAT PLATE DRAG IN MAGNETOHYDRODYNAMIC FLOW. H. P. Greenspan (Harvard Univ., Cambridge, Mass.). Phys. Fluids 3, 581-7(1960) July-Aug.

In sub-Alfvén magnetohydrodynamic flow past a flat plate (the free stream fluid velocity is less than the Alfvén wave speed) the vorticity generated within the fluid is propagated upstream by Alfvén waves and produces a forward disturbance which in form is very similar to the vicous wake. The structure and strength of the wake and precursor are examined and compared for large Reynolds numbers and finite conductivity. As the conductivity increases, a larger proportion of the total vorticity is

propagated upstream so that the precursor becomes more pronounced and the wake weakens. Explicit formulas for the skin friction and drag coefficient are determined for arbitrary values of the conductivity, and the results clearly exhibit the effects of the interaction of fluid flow and magnetic field. (auth)

22219

DIFFUSION OF CHARGED PARTICLES ACROSS A MAGNETIC FIELD DUE TO NEUTRAL PARTICLES. James P. Wright (Univ. of Chicago). Phys. Fluids 3, 607-10(1960) July-Aug.

A calculation of the diffusion of charged particles across a magnetic field arising from the presence of neutral particles was compared with the diffusion arising from charged particles. The ratio of the flux of charged particles, arising from the presence of neutral particles, and the flux arising from charged particles was found to be of the order 10^2 to 10^5. The actual value of the ratio depends on the types of particles, the temperature, the number densities, and the density gradients. (auth)

22220

ON CERTAIN PROPERTIES OF HYDROMAGNETIC SHOCKS. W. B. Ericson (Grumman Aircraft Engineering Corp., Bethpage, N. Y.) and J. Bazer. Phys. Fluids 3, 631-40(1960) July-Aug.

Proofs of four basic properties of stationary, planar, nonrelativistic hydromagnetic shocks are presented. These properties are: (1) the specific entropy behind a hydromagnetic shock exceeds that ahead, if and only if, the shock is compressive; (2) the specific entropy behind a compressive shock varies in the same sense as the mass flux; (3) in the region behind (compressive) fast shocks, the fast disturbance speed is greater than the normally directed fluid velocity relative to the shock; (4) in the region behind (compressive) slow shocks, the slow disturbance speed may be less than, equal to, or greater than the normally directed fluid velocity relative to the shock. The equality holds when the specific entropy and the mass flux assume their maximum values. In these statements the state in front is assumed fixed and attention is focused on the variation of the state behind with an appropriate shock strength parameter. The proof of 1 is designed especially to cover the case of the slow shock where the dependence of the state behind on the "natural" shock-strength parameters is nonmonotonic. The proofs of 3 and 4 require the medium to be a polytropic ideal gas; however, a less stringent assumption suffices for 1 and 2. (auth)

22221

SEPARATION OF MAGNETIC DRIVING AND OHMIC HEATING. John R. Banister (Sandia [Corp.], Albuquerque, N. Mex.). Phys. Fluids 3, 648-55(1960) July-Aug.

Brief unidirectional current discharges were passed through nitrogen in the presence of a transverse uniform magnetic field. The gas between the electrodes was heated and given a directed velocity. Since flow was limited to the direction of this directed velocity, the usual shock-tube theory modified for this velocity could be used to describe shock development. This theoretical method, which provided separation of the roles of magnetic driving and Ohmic heating, was found to be precisely applicable until the material traversed more than half the electrode dimension during the discharge. The technique seems potentially useful for studying plasma conductivity and equation of state. (auth)

22222

PARTICLE DIFFUSION ACROSS A MAGNETIC FIELD. Lyman Spitzer, Jr. (Princeton Univ., N. J.). Phys. Fluids 3, 659-61(1960) July-Aug.

Particle diffusion across a magnetic field caused by fluctuations in the field was investigated. To simplify the problem, a uniform magnetic field of constant magnitude was considered. A steady state was assumed in which the statistical properties of plasma were independent of time, but the electric field was assumed to fluctuate over distances large compared with the radius of gyration and over times long compared to the cyclotron frequency. The positive ion waves were assumed to be traveling along tubes of force and uncorrelated in adjacent tubes. Results of this simplified analysis were applicable only for a positive ion temperature much less than the electron temperature. (M.C.G.)

22223

ON THE LINEAR BEHAVIOR OF LARGE-AMPLITUDE MAGNETOHYDRODYNAMIC WAVES. J. Shmoys and E. Mishkin (Polytechnic Inst., Brooklyn). Phys. Fluids 3, 661-2(1960) July-Aug.

Magnetohydrodynamic waves propagated parallel to a d-c field, assuming an incompressible fluid with finite conductivity, are discussed. The resulting equations are shown to be linear irrespective of amplitude. The current, a-c magnetic field, and electric field are all shown to be transverse. (M.C.G.)

22224

EFFECT OF A TRANSVERSE MAGNETIC FIELD ON THE "ESCAPE SPEED" OF A CONDUCTING FLUID. Carl Griefinger (RAND Corp., Santa Monica, Calif.). Phys. Fluids 3, 662-4(1960) July-Aug.

The effect of a transverse magnetic field on the "escape speed" of a conducting fluid was studied. For a given initial ratio of magnetic pressure to hydrodynamic pressure in the conducting fluid, the "escape speed" depended on the magnetic pressure in the vacuum into which the fluid expanded. The integrals appearing in the generalized Riemann invariants are evaluated analytically. (M.C.G.)

22225

COMMENTS ON "LAMINAR STEADY-STATE MAGNETOHYDRODYNAMIC FLOW IN AN ANNULAR CHANNEL." J. N. Kapur and R. K. Jain (Univ. of Delhi). Phys. Fluids 3, 664-5(1960) July-Aug.

Certain arguments used by Samuel Globe in a paper "Laminar Steady-State Magnetohydrodynamic Flow in an Annular Channel" were considered and judged incorrect. Some misprints in the paper were also pointed out. (M.C.G.)

22226

ENTROPY AND CROSS-RELAXATION IN SPIN SYSTEMS. A. E. Siegman (Stanford Univ., Calif.). Phys. Rev. 119, 562-3(1960) July 15.

Several examples of cross-relaxation and harmonic cross-relaxation between magnetic resonance transitions, both nuclear and electronic, have recently been reported. In these experiments, the appropriate cross-relaxation rate equations have generally been invoked to predict the results observed. It is pointed out that if the phenomena can be described in thermodynamic terms using the spin temperatures, then the results can be predicted in a simple fashion by maximizing the spin entropy. A simple approximation for the entropy of a multilevel spin system in terms of the population differences Δn_{ij} is derived and applied to a typical cross-relaxation problem. (auth)

22227

IONIZATION AND CHARGE TRANSFER IN PROTON–HYDROGEN ATOM COLLISIONS. Wade L. Fite, R. F.

Stebbings, David G. Hummer, and R. T. Brackmann (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. 119, 663-8(1960) July 15.

The cross sections for charge transfer and for ionization in collisions between protons and hydrogen atoms were determined over the energy range from 400 to 40,000 ev. The experiment used modulated crossed-beam techniques. Experimental results are compared with several theoretical predictions. (auth)

22228

CHARGE TRANSFER AND ELECTRON PRODUCTION IN H^- + H COLLISIONS. David G. Hummer (General Atomic Div., General Dynamics Corp., San Diego, Calif.), R. F. Stebbings, Wade L. Fite, and Lewis M. Branscomb. Phys. Rev. 119, 668-70(1960) July 15.

The cross sections for charge transfer and electron production in collisions between hydrogen atoms and hydrogen negative ions (H^-) were measured over the energy range 100 to 40,000 ev using modulated atomic-beam techniques in a crossed-beam experiment. Agreement of the experimental results with the perturbed-stationary-states calculation for charge transfer of Dalgarno and McDowell is quite satisfactory. (auth)

22229

OPTICAL PUMPING OF HELIUM IN THE $^3S_1$ METASTABLE STATE. F. D. Colegrove and P. A. Franken (Univ. of Michigan, Ann Arbor). Phys. Rev. 119, 680-90(1960) July 15.

The alignment of He^4 atoms in the (n = 2, metastable) $^3S_1$ state is described. Metastable atoms are produced by a r-f discharge in a glass tube containing a few mm of pure helium, and the one micron pumping light ($2\ ^3P - 2\ ^3S$) is provided by a helium lamp. A resonance signal is obtained from radio frequency disorientation by monitoring the transmitted pumping light. The double maximum line shape of this signal for strong r-f magnetic fields is discussed. Included also is a discussion of the angular dependence of the signal when unpolarized light is used and an explanation of the inversion of the resonance signal for certain densities of the metastable helium atoms. The measured relaxation time of the oriented metastable atoms in the discharge is about 2.5×10^{-4} second and the pumping time is about a millisecond. A method is proposed and initial measurements are given for the cross section for destruction of metastable helium atoms by collision with foreign gas atoms. The application of optical pumping in helium to the measurement of weak magnetic fields is also discussed. (auth)

22230

DISPERSION RELATIONS IN ATOMIC SCATTERING PROBLEMS. E. Gerjuoy and Nicholas A. Krall (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. 119, 705-11(1960) July 15.

Dispersion relations appropriate to the scattering of electrons by hydrogen atoms are deduced and applied to actual measurements in the 0 to 10 ev energy range. Two such experiments exist, yielding quite different results. Dispersion relations indicate that only certain angular distributions at low energy are consistent with these low-energy total cross-section measurements; this suggests experiments which could be used as checks on the accuracy of the existing measurements. (auth)

22231

CROSS SECTION FOR FORMATION OF DOUBLY-IONIZED HELIUM BY ELECTRON IMPACT. H. E. Stanton and J. E. Monahan (Argonne National Lab., Ill.). Phys. Rev. 119, 711-15(1960) July 15.

The cross section for the formation of He^{2+} by electron impact has been measured relative to that of He^+ for electron energies between 100 and 2400 ev. A relative minimum in the measured ratio of the yields of He^+ to He^{2+} at an energy of about 600 ev is believed to be real. For incident energies above 1400 ev the results are consistent with a constant value of 145 for this ratio. (auth)

22232

ELECTROMAGNETIC SIGNALS FROM NUCLEAR EXPLOSIONS IN OUTER SPACE. Montgomery H. Johnson (Ford Motor Co., Newport Beach, Calif.) and Bernard A. Lippmann. Phys. Rev. 119, 827-8(1960) Aug. 1.

The thermal x rays produced by a nuclear burst in outer space cause polarization currents in the medium which, if distributed anisotropically, will emit electromagnetic radiation. Roughly, a burst of thermal x rays, equivalent in energy to 1 ton of high explosive, produces a detectable 10 Mc/sec signal at a range of 1 km. Since only the ratio of x-ray energy to range enters into the strength of the radiated signal, other ranges follow by adjusting the x-ray energy proportionately. This works up to $\sim 3 \times 10^3$ km; beyond this range, dispersive effects begin to reduce the signal received. The power in the electromagnetic signal varies as the square of the electron density, so this effect may provide a sensitive measure of the density of electrons in outer space. (auth)

22233

AUGER ELECTRON EJECTION FROM GERMANIUM AND SILICON BY NOBLE GAS IONS. Homer D. Hagstrum (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 119, 940-52(1960) Aug. 1.

Experimental results concerning electron ejection from annealed, atomically clean surfaces of Ge and Si by the singly charged ions of the noble gases are reported. The (111) and (100) faces of Si and the (111) face of Ge were studied. Total yield and kinetic energy distribution of ejected electrons were measured and ion energies varied in the range 10 to 1000 ev. A new method of operation of the apparatus and of obtaining the kinetic energy distributions from the recorded retarding potential data was employed. Documentation of the state of the target surfaces is given including photomicrographs and electron micrographs of the Si surfaces. Since these experimental results are subsequently to be interpreted theoretically, identification of the results with the theoretical ideas only is given here. (auth)

22234

DIFFUSION OF Li IN Si AT HIGH T AND THE ISOTOPE EFFECT. E. M. Pell (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 119, 1014-21(1960) Aug. 1.

The diffusion rate of Li in Si at high temperatures was re-investigated using an outdiffusion technique. The resulting D for Li^7 is $(2.21 \pm 0.07) \times 10^{-6}$ cm^2/sec at (800 ± 5)°C and 2.4×10^{-5} cm^2/sec at (1350 ± 5)°C. If these results are combined with ion drift results, the diffusion constant can be described by $D = (2.5 \pm 0.2) \times 10^{-3} \exp[-(0.655 \pm 0.01)e/kT]$. The isotopic effect upon the diffusion was investigated using Li^6 and Li^7. At 800°C, the value for D_{Li^6}/D_{Li^7} is $1.07_5 \pm 0.02$, in accordance with the expected inverse dependence on the square root of the mass. The ionic charge of the Li and the atomic mechanism for Li diffusion is discussed in the light of these and other results. (auth)

22235

VIBRATIONAL STATES OF THE HYDROGEN MOLECU-

LAR ION. Stanley Cohen, John R. Hiskes, and Robert J. Riddell, Jr. (Univ. of California, Berkeley). Phys. Rev. 119, 1025-7(1960) Aug. 1.

The eigenvalues and eigenfunctions of the vibrational states belonging to the ground electronic state of the hydrogen molecular ion were calculated. The calculations were done for the J = 0, 2, 4, and 7 rotational states. Included is a discussion of the dependence of the eigenvalues as a function of the lowest-order dynamic corrections to the internuclear potential. The number of bound states of the D_2^+ system were calculated. (auth)

22236

HYPERFINE STRUCTURE OF THE MICROWAVE SPECTRA OF THE NO MOLECULE AND THE NUCLEAR QUADRUPOLE MOMENT OF NITROGEN. Chun C. Lin (Univ. of Oklahoma, Norman). Phys. Rev. 119, 1027-8(1960) Aug. 1.

The frequencies of the magnetic resonance spectrum of the NO molecule were recalculated by using the new value of spin-orbit coupling constants and by taking the effect of l uncoupling into consideration. The agreement between the theoretical and experimental results is improved over the previous calculation. By combining the magnetic hyperfine and nuclear quadrupole coupling constants the ratio of the quadrupole moment to the magnetic moment of the nitrogen nucleus is obtained. The nuclear quadrupole moment of nitrogen is found to be $(0.016 \pm 0.007) \times 10^{-24}$ cm^2 The uncertainty of this value is chiefly due to that of the coupling constants rather than to the nature of the method itself. (auth)

22237

ON AN EQUATION FOR PARAXIAL OPTICS OF ELECTRON BEAMS WITH HIGH CURRENT DENSITY. B. T. Kormilitsin and V. T. Ovcharov. Radiotekh. i Elektron. 5, 1112-17 (1960) July. (In Russian)

A solution is developed for the basic equation of high-current-density electron beam paraxial optics. It is shown that the derived equation is satisfactory at any arbitrary current density. The equation considers both potential along the beam axis and space charge within the beam. Conditions under which the component of charge can be eliminated are described. (tr-auth)

22238

DOSE MEASUREMENT BY AUTORADIOGRAPHY. Giovanna Mayr (Universität, Cambridge, Eng.). Strahlentherapie 112, 469-71(1960) July. (In German)

For the quantitative dose determination of an autoradiographic blackened film the silver that was deposited on the film following phototechnical work is reactivated in a reactor by neutron irradiation and the radioactivity is compared with a standard of a known dose. The method provides sufficient accuracy. (auth)

22239

THE EXCITATION AND LUMINESCENCE MECHANISMS OF RARE GASES AND RARE GAS MIXTURES IN BOMBARDMENT WITH FAST ELECTRONS. Wolfgang Friedl (Universität, Giessen, Ger.). Z. Naturforsch. 15a, 398-404 (1960) May-June. (In German)

In order to study the excitation and luminescence mechanisms of rare gases and rare gas mixtures in bombardment with fast electrons, the decay times of the luminescence and the spectra were investigated in dependence on the gas pressure. The decay time–pressure curves of the rare gases Ne, Ar, Kr, and Xe have a maximum. This suggests the same excitation mechanism. The pressure dependence in He varies irregularly, probably because of the strong intercombination prohibition. The maxima were reduced to step excitations over the metastable levels. By admixture of O_2 and N_2 the concentrations of the metastable rare gas atoms were decreased, the decay times were affected, and (especially by O_2) the continua were weakened. In Ne–Ar mixtures the decay-pressure curve shows that practically no excitation of Ar atoms results from collisions of the second type with Ne atoms. In Ar–Xe mixtures it is indicated that the excitation of Xe by collisions of the second type with metastable Ar atoms is of significance. The spectra of these mixtures contain two bands which were emitted probably by ArXe molecules. (tr-auth)

22240

CYCLOTRON RESONANCE AND THE GENERATION OF MILLIMETER WAVES. D. T. Swift-Hook and A. Reddish (General Electric Co., Ltd., Wembley, Eng.). p.261-87 of "Proceedings of the Symposium on Millimeter Waves." Brooklyn, Polytechnic Institute, 1959.

The use of natural 'cyclotron' oscillation of electrons in a magnetic field was investigated for the amplification and generation of very high frequencies (as in early magnetrons). The absence of a slow-wave structure made this particularly attractive for millimeter wavelengths. Analysis is presented for a number of geometries, a linear magnetron with a gun at one end and a depressed collector at the other appearing particularly favorable. The theoretical maximum efficiency is 65%; the frequency is tunable over a wide range by variation of the magnetic field and over a few percent by variation of a voltage. Preliminary experimental results are described. (auth)

22241

IMPROVEMENTS TO MATERIALS SERVING AS SOURCES OF NUCLEAR FISSION PRODUCTS. (to Rensselaer Polytechnic Inst.). French Patent 1,183,719. Feb. 2, 1959.

A fibrous mineral was developed containing fissile or fertile material. The diameter of the fibers can be so small (a few μ) that the fission products escape, after which they can cause chemical reactions or can be recovered.

22242

NEUTRON SOURCE. J. S. Foster, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,933,611. Apr. 19, 1960.

A compact electronic device capable of providing short time high density outputs of neutrons is described. The device of the invention includes an evacuated vacuum housing adapted to be supplied with a deuterium, tritium, or other atmosphere and means for establishing an electrical discharge along a path through the gas. An energized solenoid is arranged to constrain the ionized gas (plasma) along the path. An anode bearing adsorbed or adherent target material is arranged to enclose the constrained plasma. To produce neutrons a high voltage is applied from appropriate supply means between the plasma and anode to accelerate ions from the plasma to impinge upon the target material, e.g., comprising deuterium.

22243

DETERMINATION OF SPECIFIC NEUTRONIC REACTIVITY. G. Dessauer (to U. S. Atomic Energy Commission). U. S. Patent 2,936,274. May 10, 1960.

A method is given for production-line determination of the specific neutronic reactivity of such objects as individual nuclear fuel or neutron absorber elements and is notable for rapidity and apparatus simplicity. The object is incorporated in a slightly sub-critical chain fission reactive assembly having a discrete neutron source, thereby establishing a k_{eff} within the crucial range of 0.95 to 0.995. The range was found to afford, uniquely, flux-transient-

damped response in a matter of seconds simultaneously with acceptable analytical sensitivity. The resulting neutron flux measured at a situs spaced from both object and source within the assembly serves as a calibrable indication of said reactivity.

Astrophysics and Cosmology

22244
THEORY OF RESONANCE REACTIONS. Luciano Fonda and Roger G. Newton (Indiana Univ., Bloomington). Ann. Phys. (N. Y.) 10, 490-515(1960) Aug.

A general formal theory of resonance reactions and scattering is developed without the use of channel radii. The approach employed allows a simple physical interpretation of the two energies, one of which must be kept fixed while the other one is varied in order for a Breit–Wigner denominator to vanish. A new result, obtained without a weak channel coupling hypothesis, is that a sharp resonance may be caused by forces which, if slightly different, would lead to a stable bound state even in the presence of strong coupling to open channels. The possibility of shapes other than the usual Breit–Wigner type is also discussed. A special formula is derived for resonances near a threshold caused by bound states just below that threshold in the same channels where the peak is seen. (auth)

22245
LIMITATIONS TO DISPERSION RELATIONS. John G. Taylor (Univ. of Cambridge, Eng.). Ann. Phys. (N. Y.) 10, 516-35(1960) Aug.

An attempt was made to understand the limitations to the validity of dispersion relations by considering fourth-order terms for elastic scattering in perturbation theory. For the exchange scattering of equal mass, scalar, neutral bosons, $\Delta^2_{max} = 2m^2$ was obtained for the limit of the validity of the general proof, but closer inspection showed that the dispersion relation was satisfied by this diagram for all values of the momentum transfer Δ. This was also the case for nucleon-nucleon exchange scattering. The general limitations on Δ^2 appeared to arise from natural examples, and the method of proof using analyticity in the mass of the projectile particle had to be extended considerably to enable examples to be considered. No general limitations on Δ^2 arose from the direct scattering term in fourth order, but did so when anomalous thresholds were allowed. It did not seem possible to use the general method of proof in this case. (auth)

22246
QUANTUM ELECTRODYNAMICS IN THE INFINITE ENERGY LIMIT. Kenneth Johnson (Massachusetts Inst. of Tech., Cambridge). Ann. Phys. (N. Y.) 10, 536-52(1960) Aug.

The spectral form of the single particle Green's functions of charged fields are derived for spin zero and spin one-half fields. The restrictions imposed on the spectral weight functions by the commutation relations and the "kinematic" coupling of the charged field to the electromagnetic field are studied. It is shown that they require extremely slow convergence of the infinite integrals over the weight functions. In fact, the commonly made assumptions of uniform convergence of all such integrals with respect to any parameter of interest would lead to a contradiction of the consistency of the theory. However, it is pointed out that "reasonable" solutions of the theory could exist with the requisite convergence properties. (auth)

22247
PERTURBATION THEORY IN STATISTICAL MECHANICS AND THE THEORY OF SUPERCONDUCTIVITY. David J. Thouless (Univ. of Birmingham, Eng.). Ann. Phys. (N. Y.) 10, 553-88(1960) Aug.

The connection between formal perturbation theory and the modern theory of superconductivity is investigated. It is found that the condition for ladder diagrams to give a convergent sum is identical with the condition for the temperature to be above the critical temperature. The effect of the residual terms of the Hamiltonian is investigated and found to be small. They give rise to a correlation between electrons in the normal state, and to a $|T-T_c|^{-\frac{1}{2}}$ singularity in the specific heat, but with a very small coefficient, in both the normal and superconducting states. These effects are caused by the existence of a collective mode whose spectrum becomes imaginary at the critical temperature. It is found that, below the critical temperature, most of the divergence is removed by using the Bardeen et al. (BCS) Hamiltonian as the unperturbed Hamiltonian, but that ladder diagrams with momentum exactly zero still diverge. These results are not affected by the Coulomb interaction, and it is suggested that the phonon-like collective mode continues to exist at nonzero temperatures, although it was shown not to exist at zero temperature. The convergence of the ladder diagrams is suggested as a criterion which the BCS solution must satisfy, and it is shown that this is equivalent to requiring the BCS solution to give a local minimum of the thermodynamic potential. This criterion is used to investigate some more complicated interactions. It is found that there is an interaction for which pairing of particles with opposite spin or with the same spin is not possible, and a more complicated trial wave function must be used. A predominantly P-state force is found to give a solution of the equations which appears to represent a state with ferromagnetic properties. (auth)

22248
APPROXIMATE EXPERIMENTAL EVALUATION OF THE METEORITE IONIZATION PROBABILITY. E. I. Fialko (Karpov Tomsk Polytechnic Inst., USSR). Izvest. Vysshikh Ucheb. Zavedenii, Fiz. No. 1, 90-2(1960). (In Russian)

An approximate experimental evaluation is given for the exponent n specifying the dependence of meteorite ionization β on mass $v(\beta \sim v^n)$. The dependence proved to be weak. (tr-auth)

22249
A STUDY OF NEUTRAL HYDROGEN IN THE SOLAR NEIGHBOURHOOD OF THE MILKY WAY. R. D. Davies (Jodrell Bank Experimental Station, Lower Withington, Ches., Eng.). Monthly Notices Roy. Astron. Soc. 120, 483-97(1960).

The distribution of neutral hydrogen away from the galactic plane was measured between Dec. = +90° and Dec. = −32°. It showed a number of neutral hydrogen clouds which coincided in position with dust complexes. The major feature of the distribution was the excess of neutral hydrogen in the position of the local system (Gould's Belt) of early-type stars and dust. The system ($\sim 10^5$ M⊙) appeared to represent a later formation in the local spiral arm. An extended region in Cepheus is probably similar. (auth)

Cosmic Radiation

22250 AFCRC-TR-60-211
Weizmann Inst. of Science, Rehovoth, Israel.
RESEARCH ON THE INTERACTION OF VERY HIGH ENERGY COSMIC RAY PARTICLES. Technical Final Report

Covering the period from April 1, 1958 through September 30, 1959. 34p. Contract AF61(052)-58. (AD-231785).

Particle production by cosmic primaries was studied both theoretically and experimentally. A model describing meson production in N-N and N-nucleus collisions in terms of excited nucleons was developed. Collisions in CNO and AgBr between 100 and 1600 Bev were calculated. The possibility of meson production by a process similar to that of Cherenkov radiation of photons was examined at extremely high energies. Preliminary experimental results are reported. (W.D.M.)

22251

NUCLEAR INTERACTIONS OF HIGH ENERGY HEAVY NUCLEI OF PRIMARY COSMIC RADIATION. E. Balea, E. Friedländer, M. Oncescu, C. Potoceanu, and M. Sahini. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 61-8(1960). (In Rumanian)

The interaction of 17 primary nuclei with charge $Z \geq 2$ and mean energy $\sim 10^{11}$ ev/nucleon was studied with respect to the angular distribution of the relativistic particles. A structure with two cones compatible with the "two center" model in the center-of-mass system was found. In the majority of cases the evaporation jet of the incident residual nucleus can not be detected. It appears probable that its nucleons are elastically scattered on the nucleons of the target nucleus. (tr-auth)

22252

INVESTIGATION OF THE ANGULAR DISTRIBUTION OF SECONDARY PARTICLES, PRODUCED AS A RESULT OF NUCLEAR INTERACTION BETWEEN HIGH ENERGY PARTICLES. G. Bozoki, E. Fenyves, and E. Gombosi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetenek Közleményei 6, 339-44(1958). (Translated from Referat. Zhur. Fiz. No. 2, 1960, abstract No. 3084).

A comparison is made of the angular distribution of shower particles, produced as a result of the interaction between particles of energy 10^{10} to 10^{14} ev and a nucleus, with an angular distribution given by the statistical theory of Fermi, Landau, and Heisenberg. It is found that in this case, on the basis of the analysis of the angular distribution alone, one cannot conclude the correctness of any particular theory.

22253

LOCAL INCREASE OF INTENSITY OF COSMIC RADIATION. J.-P. Legrand and A. Helary (Commissariat à l'Energie Atomique, [Paris]). Nature 187, 397-8(1960) July 30.

Local increases of cosmic radiation intensity, causes of which are unknown, were compared to determine the cause and to study earth-sun relationships. An increase in intensity was measured at the Paris station on December 4, 1957, the maximum of which occurred at 22 hr, 45 ± 20 min u.t. Only the station at Thule showed a similar increase between 18 hr and 20 hr u.t. These events and the way in which they occurred suggested an arrival of protons of solar origin. (M.C.G.)

22254

ATMOSPHERIC TEMPERATURE EFFECTS ON THE SOLAR DAILY VARIATION OF COSMIC RAY INTENSITY. J. J. Quenby and T. Thambyahpillai (Imperial Coll. of Science and Tech., London). Phil. Mag. (8) 5, 585-600(1960) June.

The solar diurnal variation of the cosmic meson intensity caused by the periodic solar heating of the atmosphere was derived from a comparison of the ionization chamber and neutron monitor data from Huancayo. The amplitude and the time of maximum were found to be 0.11% and 0.5 to 30 hr, respectively. Recent meteorological data, free from appreciable radiation errors, were found to be in rough agreement with this result. Particularly good agreement was obtained in the phases which were later than the value given by Dorman by about 4 hr. The inclusion of this temperature correction enabled the directional measurements at Mawson to be reconciled with the idea of a primary anisotropy. (auth)

22255

COSMIC-RAY INTENSITY VARIATIONS AND THE INTERPLANETARY MAGNETIC FIELD. H. Elliot (Imperial Coll. of Science and Tech., London). Phil. Mag. (8) 5, 601-19(1960) June.

The general characteristics of cosmic ray intensity variations were explained in terms of a large-scale interplanetary magnetic field of predominantly dipole character but containing small-scale irregularities which act as scattering centers. It is suggested that the cosmic ray data can be taken as evidence for the existence of such a field. The strength of the field, which is generated by current systems in the solar corona, is dependent on the level of solar activity but must in general be in the region of 10^{-5} to 10^{-4} gauss at the earth's orbit. (auth)

22256

ARRIVAL DIRECTIONS OF COSMIC-RAY AIR SHOWERS FROM THE EQUATORIAL SKY. E. V. Chitnis (Physical Research Lab., Ahmedabad, India), V. A. Sarabhai, and G. Clark. Phys. Rev. 119, 1085-91(1960) Aug. 1.

The celestial arrival directions of over 100,000 showers with sizes greater than 10^5 particles were determined by fast timing in observations at an altitude of 2034 m. The observations covered a band of declinations from −30° to +50° with an angular resolution of 4°, and they extended a survey begun in an earlier experiment that covered the northern sky. As in the earlier experiment no significant deviation from isotropy was found. The atmospheric attenuation of the shower intensity was determined from the zenith angle distribution, and also from a comparison of the absolute shower intensity at 2034 m and at sea level. Within an experimental uncertainty of about 5%, both methods yield an exponential attenuation length consistent with the value of 107 g cm^{-2} previously found at sea level. The absolute intensity of showers with more than 10^5 particles at 2034 m was found to be $(1.11 \pm 0.30) \times 10^{-9}$ cm^{-2} sec^{-1} sr^{-1}. (auth)

22257

A REVIEW OF METHODS FOR EVALUATING ENERGY AND COEFFICIENT OF INELASTICITY IN MESON SHOWERS GENERATED IN COSMIC RADIATION. E. G. Boos and Zh. S. Takibeev. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 46-63(1960). (In Russian)

A review is given of various methods for evaluating the energy of shower generating particles and of the fraction of the energy transmitted to the generated mesons. Methods based on angular distribution data for secondary particles are also analyzed. Experimental data obtained by various methods are correlated and analyzed. 35 references. (R.V.J.)

22258

ON THE MESON DISTRIBUTION ACCORDING TO THE MAGNITUDE OF TRANSVERSE PULSES IN HIGH-ENERGY SHOWERS. E. G. Boos and Zh. S. Takibaev. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 89-99(1960). (In Russian)

Distributions of transverse pulses are analyzed and systematized according to various theories of multiple meson generation and various phenomenological schemes.

Comparisons with experimental data limit the selections of possible schemes for describing the multiple generation of mesons. Assumptions on the energy of generated mesons in the center-of-mass system do not explain the observed distribution due to strong anisotropic conditions imposed. However, the complication can be eliminated by assuming that the meson energy spectrum is similar to the spectrum developed on the basis of Heisenberg theory. Experiments confirm the Heisenberg concept of transverse pulse magnitudes. (R.V.J.)

22259

APPLICATIONS OF MODIFIED "FLUX" THEORY FOR THE INTERPRETATION OF STARS FORMED BY HIGH ENERGY PARTICLES ($E \geq 10^{11}$ ev). Yu. F. Strokov. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 150-6(1960). (In Russian)

An attempt was made to explain the nature of high-energy showers by means of a modified phenomenological theory of fluxes. A theory of "fluxes" previously postulated explaining multiplicity of particles in high-energy showers ($E > 10^{11}$ ev) claimed that nucleon interactions with nuclei produced a meson flux with a small angle of dispersion which diffused in the nucleus. A modified expression of the diffusion factor indicates that not all mesons participate in the diffusion. The results, based on the modified theory of fluxes, offer qualitative data on multiplicity of particles, their angular distribution, and the multiplicity of shower particles in high energy showers. (R.V.J.)

22260

RESULTS OF CONTINUOUS REGISTRATION OF COSMIC RADIATION WITH IONIZATION CHAMBERS IN HALLE ($\phi = 51.5°N$, $\lambda = 12°E$). W. Messerschmidt (Universität, Halle, Ger.). Z. Naturforsch. 15a, 470-84(1960) May-June. (In German)

In Halle since April 1, 1956, continuous recordings of the cosmic radiation have been made with four ionization chambers (shielding 140 g/cm^2). Two chambers remain above ground, a third is in an open pit, and the fourth is placed under 14 m water equivalent. The various fluctuation magnitudes are studied in dependence on the placement of the chambers. The barometer effect, the Forbush effect, the annual period, and the 27-day period decrease with the depth. The daily period is a percentage greater under the earth than on top of the ground. With the chamber in the open pit a sidereal time period could be detected. (tr-auth)

Criticality Studies

22261 AHSB(S) Handbook I

United Kingdom Atomic Energy Authority. Authority Health and Safety Branch, Risley, Lancs, England.
HANDBOOK OF CRITICALITY DATA FOR PLANT DESIGNERS AND OPERATORS. 1960. 52p.

Criticality data are presented which are intended for use by chemical plant designers and operators. The assumptions and definitions are based on operations and accidents that might reasonably be considered possible in such plants. Graphs are presented of the four commonly encountered critical parameters: mass, volume, radius of an infinite cylinder, and thickness of an infinite slab. Curves are given for systems involving Pu^{239}, 30-93% U^{235}, 5-30% U^{235}, and less than 5% U^{235}. (W.D.M.)

22262 RFP-91

Dow Chemical Co. Rocky Flats Plant, Denver.
IN SITU NEUTRON MULTIPLICATION MEASUREMENTS ON A CALCINING FURNACE. M. G. Arthur, C. L. Schuske, and D. F. Smith. Dec. 8, 1957. Decl. June 10, 1960. 8p. Contract AT(29-1)-1106. OTS.

The cross multiplication of several three-dimensional arrays of uranium peroxide with excess water located in a commercial calcining furnace was investigated. Thirty kg of U, as the peroxide, was loaded into the furnace and the data obtained indicated that roughly 40 to 50 kg of U would be required to make the system critical. (auth)

22263 RFP-190

Dow Chemical Co. Rocky Flats Plant, Denver.
PLUTONIUM PLEXIGLAS ASSEMBLIES. PART II. G. H. Bidinger, C. L. Schuske, and D. F. Smith. Apr. 8, 1960. Changed from OFFICIAL USE ONLY May 19, 1960. 20p. Contract AT(29-1)-1106. OTS.

Neutron multiplication measurements were made on tamped and untamped cylindrical assemblies. The assemblies consisted of plutonium metal sheet moderated with Plexiglas. Experiments were performed to evaluate the effects of inhomogeneity. This work is a continuation of RFP-178. (auth)

22264

AUTOMATIC DATA REDUCTION FOR CRITICAL ASSEMBLIES. T. M. Miller, T. J. Kikta, S. H. Levine, and W. F. Vogelsang (Westinghouse Electric Corp., Bettis Plant, Pittsburgh). Nucleonics 18, No. 8, 86-7; 89-90; 92-3(1960) Aug.

A system of on-line data reduction was developed to handle the data from a critical assembly. The system consists of a digital scanner, which receives pulses from fission counters, and a translator, which puts the signals from the scanner into a form acceptable to the computer. The computer then processes the data for period measurements. The system has operated successfully for approximately one year and has resulted in a savings in man power as well as time. The advantages, disadvantages, and future plans for the system are discussed. (B.O.G.)

Elementary Particles and Radiations

22265 AD-236498

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE TRANSMISSION OF FAST NEUTRONS THROUGH IRON, ALUMINUM AND LEAD (thesis). Melvin Joseph Bina. Mar. 1960. 52p.

The transmission of Po–Be neutrons through Fe, Al, and Pb was investigated. A Hurst type, tissue equivalent, neutron detector was used in conjunction with an electronic integrator circuit which gave directly a number proportional to neutron dose rate. It was determined that the transmission number was a function of source-detector distance and a method was developed whereby the transmission number could be obtained for an effective infinite source-detector separation. The absorbing material consisted of concentric hemispherical shells $^{15}/_{16}$ in. thick and three configurations were possible; the spherical absorber, the hemispherical absorber, and the hemispherical reflector. Five shells were used for each configuration with a total resulting thickness of $4^{11}/_{16}$ inches. The dose transmission through Fe, Al, and Pb was found to be an exponential function of thickness for the hemispherical absorber configuration and, from this data, relaxation lengths were calculated to be 14.5 cm for Fe, 23.6 cm for Al, and 20.6 cm for Pb. Data were taken for Al in the hemispherical reflector and spherical absorber configurations. The results showed that approximately four inches of Al constitute an infinite reflector for fast neutrons and as a consequence, the relaxation length for the Al spherical absorber

changes to that of the hemispherical absorber for thicknesses greater than four inches. (auth)

22266 AFCRC-TN-59-433
Weizmann Inst. of Science, Rehovoth, Israel.
MONTE-CARLO CALCULATION OF MESON PRODUCTION IN NUCLEAR REACTIONS. PART I. N-N COLLISIONS AT 100 Bev REGION. Technical Scientific Note No. 1. Uri Maor and Gideon Yekutieli. [1959]. 13p. Contract AF61 (052)-58. (AD-231783).

The two known models of nucleon-nucleus reaction: the nuclear cascade and the "tunnel" models are good approximations at low and at extremely high energies respectively. A third model of nucleon-nucleus reaction "the cascade of excited nucleons" is proposed for the intermediate energy range 25 to 250 Bev. Meson production in nucleon-nucleon collisions is calculated by the Monte Carlo method. An approximate expression for the average multiplicity is obtained. Energy spectra of ejected mesons and nucleons are presented. (auth)

22267 AFOSR-TN-60-679
Cambridge Univ., England.
UNSTABLE PARTICLES IN A GENERAL FIELD THEORY. Technical Scientific Note No. 6. J. Gunson and J. G. Taylor. Feb. 1960. 12p. Contract AF61(052)-233.

The problem of unstable particles in quantum field theory is treated as one of the interpretation of complex singularities appearing in the analytic continuation of scattering amplitudes into unphysical sheets of their Lorentz invariant variables. Suitable continuations are shown to hold under certain restrictive assumptions in a general field theory, making use of unitarity and casuality of the S-matrix. The extra singularities appearing in the continuation are fixed isolated poles, in accordance with a conjecture of Peierls. (auth)

22268 CF-60-7-44
Oak Ridge National Lab., Tenn.
TIME-DEPENDENT THERMAL-NEUTRON ENERGY SPECTRA IN A MONOATOMIC HEAVY GAS. S. N. Purohit. July 11, 1960. 36p. OTS.

The time-dependent thermal neutron energy spectra, for times greater than the slowing-down time, were generated in a monoatomic heavy gas using multigroup formalism. These spectra were obtained for infinite as well as finite media of Be and graphite. The behavior of asymptotic energy spectra during the last stage of neutron thermalization and diffusion periods was studied. The thermalization time constant for the establishment of the final Maxwellian velocity distribution of neutrons, in a monoatomic heavy gas, was estimated to be equal to $(1.174\xi\Sigma_{s0}v_0)^{-1}$. Total thermalization times for neutrons in Be and graphite were found to be equal to 114 and 238 μsec, respectively. Using the energy-dependent transport mean free path, the diffusion cooling coefficient for Be was calculated to be equal to 0.890 cm^2. For graphite, under the constant diffusion coefficient assumption, the diffusion cooling coefficient was determined to be equal to 1.922 cm^2. (auth)

22269 INSJ-31
Tokyo Univ. Inst. for Nuclear Study.
A MODEL FOR MULTIPLE MESON PRODUCTION IN NUCLEON-NUCLEON COLLISIONS. K. Niu. May 13, 1960. 14p.

According to the model the details of N-N collisions, the Lorentz factors, rest masses of the two meson lumps, and the inelasticity are determined by the primary energy and "momentum of interaction" (Dp), which is the momentum difference between the initial and final state of each nucleon side in the c.m.s. It is pointed out that the dynamical properties of the elementary interactions are embedded only in the distribution of Δp, in its specific relation to recoil momentum of the nucleon, and in the structure of the meson lump. (W.D.M.)

22270 LAMS-2421
Los Alamos Scientific Lab., N. Mex.
THE PENETRATION OF RADIATION WITH CONSTANT DRIVING TEMPERATURE. Albert G. Petschek, Ralph E. Williamson, and John K. Wooten, Jr. May 1960. 41p. Contract W-7405-Eng-36. OTS.

Exact and approximate solutions for the penetration of radiation with constant driving temperature are presented. (auth)

22271 LMSD-703032
Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.
EXTRATERRESTRIAL RADIATION OF NONTHERMAL ORIGIN. S. Kownacki. June 1960. 30p.

A type of radiation where spectral energy distribution does not conform with Planck's radiation law is discussed. Various possible mechanisms of its generation are considered with particular emphasis on the "synchrotron mechanism," radiation of electromagnetic waves from fast, charged particles subjected to the centripetal acceleration by magnetic fields. An analysis of the more convincing aspects of the theory as well as its inadequacies is given with description of relevant experimental evidence. The need for further experimental and theoretical work in connection with both the synchrotron mechanism and other alternatives is presented. In particular, additional work is discussed in some detail as related to the investigation of the spectral distribution of radiation, polarization, evaluation of magnetic fields, and to the number and energies of radiating particles. Possible fields of inquiry are mentioned as well as methods of approach to the problems of developing models of alternative mechanisms. (auth)

22272 NP-8631
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab of High Energy and Tiflis State Univ., Georgian S.S.R.
ON ANGULAR DISTRIBUTION OF DECAY PRODUCTS OF $\Sigma^{\pm}$ HYPERONS PRODUCED IN HIGH ENERGY PROTON INTERACTION WITH THE EMULSION NUCLEI. Pu-in Chen, L. P. Janelidze, D. K. Kopylova, Yu. B. Korolevich, N. I. Kostanashvili, K. V. Mandritzkaya, N. I. Petukhova, O. A. Shachulashvili, and D. Tuvdendorg. 1959. 4p. (JINR-D-451).

An attempt was made to obtain accurate data on the angular distribution of ($\pi^{\pm}$) mesons from the decay of ($\Sigma^{\pm}$) hyperons produced in 9-Bev proton interactions with emulsion nuclei. Tracks from the stars with $N_h \geq 10$ were followed for 2 cm or until they came to rest in the emulsion. (W.D.M.)

22273 NP-8814(p.6-13)
Naval Research Lab., Washington, D. C.
TWO-PAIR DECAY OF THE NEUTRAL π-MESON. W. W. Wada.

The exchange effect between the electrons and positrons in $\pi^0 \rightarrow 2\gamma$ decay is investigated. Corrections to the distribution equation are considered. (W.D.M.)

22274 NP-8814(p.17)
Naval Research Lab., Washington, D. C.
A SEARCH FOR $\Sigma^+ \rightarrow p + \gamma$ DECAYS. R. G. Glasser, N. Seeman, and G. A. Snow.

A search was carried out in an emulsion stack exposed to low-energy k^--mesons for the decay mode $\Sigma^+ \rightarrow p + \gamma$. Zero $\Sigma^+ \rightarrow p + \gamma$ decays at rest were found in a sample

containing 128 Σ^+ decays at rest into the two normal modes. (W.D.M.)

22275 NP-8814(p.18-19)
Naval Research Lab., Washington, D. C.
NOTE ON THE $\Sigma^{\pm}$-HYPERON LIFETIME. R. G. Glasser, N. Seeman, and G. A. Snow.

Improvement in the measurement of the $\Sigma^{\pm}$ lifetime is discussed in terms of a different ionization parameter calibration of the parameter, more events, and a semi-automatic device to aid in taking and compiling the data. The parameter used was the gap length per unit length. Results, based on a gap-length measurement on 50 $\Sigma^{\pm} \rightarrow \pi^{\pm}$ decays and a Bartlett-type maximum-likelihood analysis, gave a mean lifetime of $\sim 1.163 \times 10^{-10}$ sec. (W.D.M.)

22276 NP-8896
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
ON THE CLOUD-CLOUD INTERACTION IN HIGH ENERGY INELASTIC NUCLEON-NUCLEON COLLISIONS. (O Oddziaływaniu Chmura-Chmura Przy Wysokoenergetycznych, Nieelastycznych Zderzeniach Nukleon-Nukleon). Report No. 144/VII. A. Krzywicki. Mar. 1960. 10p.

The role of the cloud-cloud interaction in the production of two pions in high energy, peripheral, N-N collisions is examined. It is shown, that although the distribution of final nucleons (in c.m.s.) is strongly anisotropic, the forward-backward asymmetry of final protons in p-n collision is opposite to the experimentally observed one. Thus the cloud-cloud interaction does not play any essential role in the production of two pions. (auth)

22277 NP-8900
Illinois. Univ., Urbana.
THE DETERMINATION OF A LOCAL OR ALMOST LOCAL FIELD FROM A GIVEN CURRENT. H. Araki, R. Haag, and B. Schroer. 1960. 21p.

It is shown that one cannot construct a local quantum field theory from a current operator which is a local polynomial of a free field. Secondly, the current of a local theory has to be complete or else the elastic scattering vanishes. These results do not depend in any essential way on the requirement of strict locality for the field but are only slightly modified if one allows "almost local" fields. The conditions which the current operator has to satisfy to ensure the existence of a local or almost local field are given. (auth)

22278 NP-8912
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE MEASUREMENT OF e/m. An Annotated Bibliography. Tibor Vincze. May 1960. 52p.

The period covered was from 1897 to 1959. Lists of measuring methods and diagrams are given. (W.D.M.)

22279 TID-6200
Illinois. Univ., Urbana. Electrical Engineering Research Lab.
STUDIES ON MILLIMETER WAVE GENERATION. Technical Report No. 4. Basil W. Hakki. Aug. 1, 1960. 116p. Contract AT(11-1)-392. OTS.

Methods for the generation of coherent electromagnetic radiation in the low millimeter and submillimeter range are proposed and evaluated. Harmonic generation in nonlinear media is analyzed. Maxwell's equations are solved for a medium which is characterized by a scalar linear permeability but a permittivity which is a scalar function of the electric field intensity. Two methods are used to solve the quasi-linear vector wave equation: the perturbation method, and the iterative method. The results obtained from both methods agree. The Cherenkov radiation of a bunched beam is analyzed in two slow-wave structures: dielectric tube waveguide and plasma rod waveguide. For the same operating conditions it was determined that Cherenkov radiation in a dielectric tube waveguide can be 20 or more times larger than that in an infinite medium. This was found to be due to second coherence in the slow-wave structure. It was found that Cherenkov radiation of a prebunched beam in a plasma rod waveguide can be greater than that in a dielectric tube waveguide but plasma rod waveguides are difficult to attain in the low millimeter range due to physical limitations on magnetic field intensity and/or electron density. A Doppler-Helitron oscillator is proposed based on the Doppler frequency shift which magnifies the cyclotron frequency of the beam by about 20 to 100 times. Therefore the magnetic field can be reduced by the same amount by passing the beam in a slow-wave dielectric tube waveguide whose phase velocity is close to the beam axial velocity. The magnetic field necessary for operation of this device at 300 kmc was determined to be of the order of 5000 Gauss. (auth)

22280 TID-6201
Illinois. Univ., Urbana. Electrical Engineering Research Lab.
RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON RANGE OF THE SPECTRUM. Quarterly Progress Report No. 17 [for] March 1, 1960 to June 1, 1960. P. D. Coleman, Basil Hakki, Jack R. Baird, William E. Kunz, and Joe Stafford. July 1, 1960. 55p. Contract AT(11-1)-392. OTS.

Objectives of the research are: (1) to uncover new principles or techniques from which a CW source of electromagnetic radiation for the low millimeter and submillimeter wavelength range can be developed; and (2) to develop suitable detectors, components, and measuring techniques for evaluating and using the radiation as a diagnostic tool for plasma physics. Further experimental investigations of CW plasma multipliers are being made at 8 mm with powers up to 30 w and at 3 cm with powers up to 300 w. Numerous, sharp resonances in a plasma resonator consisting of a gyromagnetic plasma column between two parallel metal plates with magnetic fields up to 4,000 gauss were observed. Difficulties in determining all the parameters of the system, in particular the plasma density, have hampered efforts in correlating the observed and calculated data. A Doppler-Helitron idea using a dielectric cavity resonator is being considered. By employing the Doppler effect, an attempt is being made to see if the effective cyclotron frequency can be substantially reduced thereby avoiding the problem of 100 to 1,000 kilogauss magnetic fields. (For preceding period see TID-5821.) (W.D.M.)

22281 UCRL-5955
California. Univ., Livermore. Lawrence Radiation Lab.
TABLE OF PROTON-PROTON SCATTERING PHASE SHIFT AS CALCULATED FROM THE ONE-PION EXCHANGE CONTRIBUTION. Bradley M. Johnston and Michael J. Moravcsik. Apr. 5, 1960. 18p. Contract W-7405-eng-48. OTS.

The table gives the proton-proton nuclear-bar phase shifts as calculated from one-pion exchange contribution. Phase shifts and mixing parameters are given in degrees, as functions of T, the laboratory kinetic energy of the incoming protons in Mev. Phase shifts and mixing parameters are listed in the angular momentum states S, P, D, F, G, H, I, and J for T = 0.25(0.25)10(0.50)40(1)100(2)400. (W.D.M.)

22282 UCRL-9128

California. Univ., Berkeley. Lawrence Radiation Lab. THE PRODUCTION OF ANTINUCLEONS BY PIONS (thesis). Owen C. Eldridge, Jr. June 7, 1960. 92p. Contract W-7405-eng-48. OTS.

A general discussion of the dissociation of diatomic molecules and molecular ions by electric fields is presented. These calculations pertain primarily to the ground electronic states of the molecular systems. The H_2^+ ion is treated in considerable detail; the required fields for the dissociation range from 10^5 v/cm for the uppermost vibrational state to 2×10^8 v/cm for the ground state. The many-electron homonuclear ions are treated in successive charge states. The HD^+, HT^+, HD, LiH^+, and LiH^{++} heteronuclear ions are considered. The dissociation of homonuclear ions and heteronuclear ions exhibit distinctly different features. The HD^+ and HT^+ ions are more susceptible to dissociation than is H_2^+. The extent to which the dissociation by an electrostatic field and by the Lorentz force, $e\vec{v} \times \vec{B}$, are equivalent is considered. The rates of induced dipole transitions to lower vibrational states can be made negligibly small compared with the dissociation rates. The application of this work to particle accelerators and to the injection problem for fusion devices is discussed. (auth)

22283 UCRL-9194

California. Univ., Berkeley. Lawrence Radiation Lab. PHOTOPION PRODUCTION FROM DEUTERIUM NEAR THRESHOLD (thesis). William P. Swanson. Apr. 1960. 135p. Contract W-7405-eng-48. OTS.

The reactions (1) $\gamma + d \rightarrow \pi^- + 2p$ and (2) $\gamma + d \rightarrow \pi^+ + 2n$ were observed near threshold by using the electron synchrotron and a 4-inch deuterium bubble chamber modified for operation in a high-energy photon beam. A 194-Mev bremsstrahlung beam, hardened by one radiation length of LiH, with an average intensity $0.8 \cdot 10^6$ Mev/pulse, was incident on the chamber. A total of 1309 π^- and 447 π^+ events was found in 200,000 photographs. The events were kinematically analyzed by an IBM-650 computer using a least-squares method. Two-prong events were weighted for chamber geometry by an IBM-704 computer using a Monte Carlo technique. The ratios σ^-/σ^+ were determined as a function of laboratory-system photon energy and meson c.m. angle. These ratios include negative Coulomb corrections of 13%, 7%, and 7%, respectively. An attempt was made to obtain the free-nucleon cross sections ($\gamma + n \rightarrow \pi^- + p$) by using the Chew-Low technique of extrapolating data from reaction (1) to a pole in the transition amplitude located at a negative (nonphysical) value of the kinetic energy of the lower-energy proton in reaction (1). Straight-line extrapolations at five effective laboratory-system photon energies in the range k = 153 to 174 Mev gave an average value $\sigma^-/\sigma^+ = 1.7 \pm 0.2$ when compared with recent positive photomeson data. Total and differential cross sections for reaction (1) were obtained for the photon energy range k = 150 to 157.5 Mev. (auth)

22284 UCRL-9289

California. Univ., Berkeley. Lawrence Radiation Lab. DOUBLE DISPERSION RELATIONS AND UNITARITY AS THE BASIS FOR A DYNAMICAL THEORY OF STRONG INTERACTIONS. Geoffrey F. Chew. June 20, 1960. 104p. Contract W-7405-eng-48. OTS.

A series of lectures is presented which are to be delivered in part at the Summer School of Theoretical Physics, Les Houches, July 1960, and in part at the Scottish Universities Summer School in Physics, Edinburgh, August 1960. Field theory is not used; instead the Mandelstam representation is accepted as a starting point and the consequences are investigated, in an attempt to make plausible the conclusion that analyticity and the substitution law, together with Lorentz invariance and unitarity, are sufficient to determine the S matrix. Specific situations considered include N-N, π-π, and π-N scattering. (W.D.M.)

22285

CONCERNING THE PROBLEM OF $\pi-\mu$ DECAY. Serban Titeica. Acad. rep. populare Romîne, Inst. fiz., atomică şi Inst. fiz. Studii cercetări fiz. 9, 411-27(1958). (Translated from Referat. Zhur. Fiz. No. 11, 1959, abstract No. 24411).

Measurements have shown that the angular distribution of the μ mesons produced as a result of pion decay is anisotropic. As a result of this, it is possible to assume that the spin of the π meson does not equal to zero and that the particle was partially polarized during the instant of decay. An attempt is made to calculate the angular distribution of the μ mesons for an arbitrary value of the spin and polarization of the π meson.

22286

ABSORPTION CURVE OF THE Y^{90} β RADIATION IN LIGHT ELEMENTS. J. Friedländer. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 97-102(1960). (In Rumanian)

Deviations from logarithmic linearity of the attenuation of the Y^{90} β radiation in light elements are described by an empirical relationship implying two parameters. Possible uses of the newly introduced parameter are discussed. (auth)

22287

THE UNITARITY RELATIONSHIPS BETWEEN THE PARAMETERS OF THE SCATTERING MATRIX FOR ELASTIC COLLISIONS BETWEEN PARTICLES WITH ARBITRARY SPIN. I. Brăndus. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 149-60(1960). (In Rumanian)

From the unitarity relationship of the scattering matrix for elastic collisions between particles with arbitrary spin, the relationships between the scattering parameters are calculated. (tr-auth)

22288

THE SCATTERING MATRIX FOR ELASTIC COLLISIONS OF PARTICLES WITH SPIN. I. Branduş. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 295-301(1960). (In Rumanian)

The scattering matrix for elastic collisions between particles with random spin and spinless particles in the presence of a spin-orbit interaction is obtained. The matrix is expressed by δ_{lj} phases and its dependence on spin is directly obtained in the matrix form by using projection operators. The operators are constructed in the form of polynomials in $(\vec{s},\vec{l})$, where the coefficients are solutions of systems of linear algebraic equations. The mean value is calculated at the final state of spin tensor operators. The matrix traces intervening are expressed as sums of the products of Clebsch-Gordan coefficients. (tr-auth)

22289

ON THE ELECTRICAL POLARIZABILITY OF THE NEUTRON. N. Martalogu and I. Minzatu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 303-13(1960). (In Rumanian)

The electrical polarizability constant α is estimated, by using a symmetrical pseudoscalar meson theory, in the nonrelativistic approximation. When comparing the value obtained with other values, it is concluded that the present

one fully agrees with the data obtained from experimental photoproduction of pions and Compton scattering of nucleons; but in the case of fast neutrons scattering on heavy nuclei, the same values no longer agree with the data obtained. In the second part of the work, some considerations are made on the effects of the spin and electrical polarization in the elastic differential scattering cross section of the fast neutrons in heavy nuclei. (auth)

22290

DETERMINATION OF THE NEUTRON FLUX ENERGY DISTRIBUTION BY ACTIVATION AND TRANSMISSION EXPERIMENTS. M. Sabău and I. Zamfirescu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 351-6(1960). (In Rumanian)

A method is given for the determination of the energy distribution of neutron flux or other particles. The method is based on the solution of $A_j = \int_{E_0}^{E_1} \sigma_j(E)\phi(E)dE$ by its decomposition into a sum and the solution of a system of linear equations. The errors are estimated, and the same procedure is applied to transmission experiments. (tr-auth)

22291

ENERGY SPECTRA OF CHARGED PIONS PRODUCED IN pd-COLLISIONS AT 660 Mev. H. Helfer, A. S. Kuznetsov, M. G. Mescheryakov, W. Świątkowski, and V. G. Vovchenko (Joint Inst. for Nuclear Research, Dubna, USSR). Acta. Phys. Polon. 19, 227-34(1960). (In English)

The energy spectra of charged pions produced in pd- and pp-collisions were measured using a magnetic spectrometer. The differential cross sections for the $p + d \rightarrow \pi^+$, $p + d \rightarrow \pi^-$, and $p + p \rightarrow \pi^+$ processes at 90° in the center of mass system of two colliding nucleons were found to be $5.0 \pm 0.6 \times 10^{-28}$, $0.57 \pm 0.08 \times 10^{-28}$, and $6.7 \pm 0.7 \times 10^{-28}$ cm^2/sterad, respectively. The ratio of the efficiency of positive pion productions on protons in deuterons and on free protons is equal to 0.79 ± 0.08. (auth)

22292

MUON ABSORPTION BY CARBON-12 AND THE UNIVERSAL FERMI INTERACTION. Jayanti Dharma Teja. Arch. sci. (Geneva) 12, 131-215(1959) Apr.-June. (In French)

Consideration is given to an experimental measurement of the intensity ratio of muon–nucleon reactions and electron–nucleon reactions which should equal unity according to the Fermi universal interaction hypothesis. Negative muons from the CERN synchrocyclotron were stopped in C, and the probability P_μ of the transition $\mu^- + C^{12} \rightarrow B^{12} + \nu$ between the ground states of C^{12} and B^{12} was measured. $P_\mu = (8.9 \pm 0.5) \times 10^3$/sec (when a correction of 10% at most is applied to account for eventual formation of excited states). The rate P_β of beta decay of B^{12} to the ground state of C^{12} is 32.64 ± 0.65/sec. P_β is known with good precision and has been made the object of numerous independent studies. The ratio P_μ/P_β is, as a result, found equal to 273 ± 13. Several theoretical evaluations of P_μ are presented. They are obtained by assuming the equality of the intensities of muon–nucleon and electron–nucleon interactions. The values found are grouped around $P_\mu = (8.00 \pm 2.0)\ 10^3$/sec. The good agreement between theory and experiment should be noted. The uncertainty in the theoretical calculation of P_μ is due to the important transfer of the quantity of movement which accompanies the μ^- absorption reaction, to the short wavelength of the neutrino emitted, and to matrix element contributions. Comparison of experiment and theory leads to the conclusion that electron–nucleon and muon–nucleon interactions are equal in intensity. (tr-auth)

22293

TOWARDS A THEORY OF THE INELASTIC SCATTERING OF ELECTRONS IN A SOLID BODY. A. Ya. Vyatskin (Leningrad Inst. of Precision Instrumentation and Optics). Fiz. Tverdogo Tela 2, 122-32(1960) Jan. (In Russian)

Transitions arising from two-body coulomb interactions of electrons of non-relativistic energy with electrons of a lattice, examined in the strong coupling approximation (for the lattice electrons), divide into two forms of transitions: interband free transitions and interband n-transitions. In the latter form of transitions the inelastically scattered electrons experience discrete characteristic energy losses which depend on the lattice parameters. This general conclusion, now shown to be correct in two extreme approximations (weak and strong coupling), ought to be adequately correct in all intermediate cases. Explicitly derived for metals, it may be extended to dielectrics and semiconductors. In the approximation of small wave number the majority of the results (the energy exchange in n-transitions, certain angular dependences) are similar to the analogous results in the weak-coupling approximation. It is concluded that losses caused by the interaction of electrons with lattice electrons, described in the weak coupling approximation, represent fundamental mechanisms of inelastic scattering. (TTT)

22294

POLARIZATION AND SCATTERING EXPERIMENTS WITH 4-MEV PROTONS. J. Saladin and P. Marmier (Physikalisches Institut der ETH, Zurich). Helv. Phys. Acta 33, 299-328(1960) July 1. (In German)

The polarization and differential cross sections of elastically scattered 4 Mev-protons were measured as a function of the scattering angle for Al, Mg, Ti, and V. Experimental results for Al are compared with predictions from optical model theory. It is found that good qualitative agreement is obtained for Al, Mg, and Ti. The angular distribution of inelastically scattered protons is quoted and discussed. (auth)

22295

AGE TO INDIUM RESONANCE FOR NEUTRONS FROM THE $T(p,n)He^3$ REACTIONS. B. Henry (Commissariat a l'Energie Atomique, Grenoble, France) and J. Rastoin. Inds. atomiques 4, No. 5-6, 55-60(1960). (In French)

The age to indium resonance in water for neutrons from the $T(p,n)He^3$ reaction was measured. It was measured in the axis of the beam of incident protons. Four successive values were assigned to the proton energy. The age varies between 16.4 ± 0.8 cm^2 for T_p = 2 Mev and 10.3 ± 0.8 cm^2 for T_p = 1.25 Mev. The anisotropy of the neutron source, contributed by the neutron source, makes the interpretation of the results delicate. Their comparison with the ages calculated by the Monte Carlo method is coherent. A program of complementary experimentation is proposed. (tr-auth)

22296

BINDING ENERGY OF NUCLEON-HYPERON SYSTEMS. V. A. Filimonov (Scientific-Research Inst., Kerov Tomsk Polytechnical Inst., USSR). Izvest. Vysshikh Ucheb. Zavedenii, Fiz. No. 1, 60-3(1960). (In Russian)

It is shown that at short distances hyperon forces have no repulsive force, in which case the systems of bound particles have large mass defects. The stability of such systems to nucleon transition is analyzed using a system of λ particles and nucleons. (R.V.J.)

22297

ON THE PROBLEM OF POLARIZED ELECTRON MOTION IN MAGNETIC FIELD. I. M. Ternov and V. S. Tumanov

(Moscow State Univ.). Izvest. Vysshikh Ucheb. Zavedenií, Fiz. No. 1, 155-63(1960). (In Russian)

The interaction of polarized electrons with a photon vacuum is investigated. Perturbation theory was used to show that vacuum fluctuations induce periodic electron transitions from one polarization state to another. Calculations are made of the influence of the effective vacuum interaction energy on the polarization of electrons free from v/c disintegration. The data hold true for the electron motion at ultrarelativistic velocities. (R.V.J.)

22298

TRANSFORMATION GROUPS AND PROPER STATES IN NEUTRINO THEORIES. K. H. Tzou (Institut Henri-Poincaré, Paris). J. phys. radium 21, 537-43(1960) June. (In French)

In the case of a particle of spin 1/2 and of zero rest mass, the proper states generated by the inversion group G in the four-component as well as in the two-component theory are identified. The constant of motion γ_5, chirality, which is intimately connected to gauge invariance M, is taken into consideration. On the other hand, owing to an arbitrariness in the choice of the definition of solutions in the case of zero rest mass, charge conjugation leads to gauge invariance C, when a neutral particle is considered. It is shown that gauge invariance M is a perfect invariance, but gauge invariance C is not, if one takes into account angular momentum, helicity and chirality quantum numbers. (auth)

22299

ON THE ANGULAR DISTRIBUTION OF THE SCATTERED PARTICLES IN COULOMB EXCITATION. Jens Bang. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 32, No. 5, 1-16(1960). (In English)

The angular distribution of scattered particles in Coulomb excitation is calculated for the case of electric quadrupole excitation and vanishing energy transfer. Numerical values are given for a number of scattering angles and incident energies. An expression for the cross section at a deflection angle equal to zero is derived, which is valid for finite energy transfer. (auth)

22300

MEASUREMENT OF THE DIFFUSION LENGTH OF NEUTRONS IN WATER. Gyula Csikai and Kálmán Dede. Magyar Tudományos Akad. Atommag Kutató Intézete (Debrecen), Közlemények 2, 15-28(1960). (In Hungarian)

For determining the neutron diffusion length in moderators with hydrogen content, a stationary method was elaborated using a small quantity of the substance. The applicability of the method was verified by the measurement of the diffusion length in water. $L = 2.73 \pm 0.08$ was obtained, which is in good agreement with the latest results of measurement, as well as with the measurements made in an infinite moderator. This method is particularly advantageous when applied to investigating the neutron diffusion parameters of organic moderators, for which only small quantities are available. (auth)

22301

POLARIZATION OF ELASTICALLY SCATTERED GAMMA QUANTA. Istvan Lovas. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közleményei 6, 367-72 (1958). (Translated from Referat. Zhur. Fiz. No. 2, 1960, abstract No. 2882).

The polarization of elastically scattered gamma quanta in Delbruck scattering differs from the polarization of gamma quanta scattered by other processes. This difference makes it possible to prove experimentally the presence of Delbruck scattering.

22302

KINEMATIC ANALYSIS OF ANGULAR DISTRIBUTIONS. G. I. Kapylov (Joint Inst. for Nuclear Studies, Dubna, USSR). Nauch. Doklady Vysshei Shkoly, Fiz.-Mat. Nauki No. 1, 150-7(1959). (In Russian)

In multiple production of particles at high energies the construction of energy spectra is complicated by the difficulty in measuring energies, the average angle of emission being used ordinarily to evaluate the average particle energy. Specific cases are given where the energy spectrum of secondary particles in the center-of-mass system can be reconstructed from their angular distribution in the laboratory system. Two expressions are presented for energy spectra in the center of mass system. The first is for slow secondary particles ($e^* < m\gamma$), assuming that their angular distributions are known in both systems and that the center of mass angular distribution is independent of the particle energy (e^*). "m" is the mass of the particle, while γ is the relativistic factor. The second is for fast secondary particles ($e^* > m\gamma$) produced in high energies ($\gamma \gg 1$) given that the laboratory system angular distribution is known and that the energy spectrum is a slowly varying function of e^*. The energy spectrum can be accurately calculated ($\sim\gamma-4$) by using this expression. The question as to whether or not laboratory system angular distributions can be used to determine energy spectra without the separation of slow and fast particles is still open. (TTT)

22303

DIRECT INTERACTION IN THE p−2p REACTION. A. M. Green and G. E. Brown (Univ. of Birmingham, Eng.). Nuclear Phys. 18, 1-13(1960) Aug. (1). (In English)

An analysis of p−2p reactions was carried out. With good energy resolution in detection of the particles, it would be possible to obtain important information about the energies of shell model levels. Treatment of the direct interaction part of the process as a surface reaction was justified. Calculations in the direct interaction formalism showed strong correlations in the angle of the two emitted protons. (auth)

22304

PION-NUCLEON ATTRACTION AT SHORT DISTANCES. S. Doniach and E. Yamada (Univ. of Liverpool). Nuclear Phys. 18, 14-22(1960) Aug. (1). (In English)

That a theory which treats the π-meson as a strongly bound nucleon-antinucleon state could provide an explanation for the observed isobaric-spin dependence of the meson-nucleon s-wave scattering length is suggested. The consistency of this proposal is tested using a simple model. (auth)

22305

RESONANCE BEHAVIOUR OF SCATTERING AMPLITUDES IN DISPERSION RELATIONS. John W. Moffat (RIAS, Baltimore). Nuclear Phys. 18, 75-80(1960) Aug. (1). (In English)

A Breit-Wigner resonance behavior of the total cross section for a model of pion-nucleon scattering is deduced from a relativistic dispersion relation and a physical energy spectrum. In virtue of the analyticity of the scattering amplitude in the cut plane of the energy an expression is derived for the scattering amplitude which has the form of the solution to the Hilbert problem in the theory of singular integral equations. The scattering amplitude is therefore determined by the behavior of a phase angle ϑ. Points of discontinuity in ϑ correspond to the location of resonances and lead to a Breit-Wigner formula for the total cross section. (auth)

22306

A NOTE ON SCATTERING AND PRODUCTION AMPLITUDES. A. P. Balachandran and N. R. Ranganathan (Univ. of Madras, India). Nuclear Phys. 18, 81-4(1960) Aug. (1). (In English)

A relation between scattering and production amplitudes for processes involving an arbitrary number of final channels was arrived at following a method due to Sucher and Day. Possible applications of this equation to $\pi-\pi$, $K-\bar{K}$, and $\pi + \pi \rightarrow K + \bar{K}$ scatterings are pointed out. Also a simple and exact expression for the $\gamma-\gamma$ scattering amplitude in terms of the amplitude for the process $\gamma + \gamma \rightarrow e^- + e^+$ was obtained. (auth)

22307

RECOIL IN PION-NUCLEON SCATTERING. V. Gupta (Tata Inst. of Fundamental Research, Bombay). Nuclear Phys. 18, 85-90(1960) Aug. (1). (In English)

The dependence of the pion-nucleon scattering cross section on nucleon recoil is shown. The method of canonical transformations was used to obtain the scattering operator explicitly. Numerical results are given for $\pi^+ + p \rightarrow \pi^+ + p$ and the cross section is found to decrease with increase of recoil. No attempt was made to fit results with experiment as the calculation is in the lowest order perturbation theory. (auth)

22308

STRONG INTERACTIONS AND ISOBARIC GAUGE INVARIANCE. V. Gupta (Tata Inst. of Fundamental Research, Bombay). Nuclear Phys. 18, 149-52(1960) Aug. (1). (In English)

Isobaric gauge invariance of the free fermion Lagrangian is demanded and it is shown that it is possible to introduce the pion field and its pseudoscalar and pseudovector couplings under a restricted gauge transformation. It is also possible to introduce the vector coupling in a similar way. The removal of the restrictions on the gauge would require the introduction of additional interaction terms. (auth)

22309

A POSSIBLE MODEL FOR THE FOUR-FERMION COUPLING. E. van der Spuy (Universitetets Institut for Teoretisk Fysik, Copenhagen). Nuclear Phys. 18, 153-60 (1960) Aug. (1). (In English)

Starting from a possible modification of the photon-propagator in electrodynamics, below a fundamental length, a generalization of the cohesive vector meson field thus introduced gives a possible model for the four-fermion coupling effective in, for example, β decay. The model is based on a charged intermediate vector meson field of the same coupling constant as for electrodynamics. The fundamental implications of a cohesive field demand a partition of Hilbert space as proposed by Heisenberg. Some implications of the model relative to the universality of the coupling and the mass of the cohesive meson are briefly indicated. (auth)

22310

THE MEASUREMENT OF THE K_1-K_2 MASS DIFFERENCE. W. S. C. Williams (The University, Glasgow). Nuclear Phys. 18, 173-5(1960) Aug. (1). (In English)

A method for measuring the mass difference of K_1^0 and K_2^0 mesons was developed. The transmission of a monoenergetic beam of K_2^0 mesons through a larger number of thin absorbers would be measured. The absorbers would be arranged so that the transmission varied in a manner directly related to the $K_1^0-K_2^0$ mass difference. (M.C.G.)

22311

MEASUREMENT OF THE TEMPERATURE DEPENDENCE OF NEUTRON DIFFUSION IN WATER AND DIPHENYL BY THE PULSE METHOD. M. Küchle (Inst. für Neutronenphysik und Reaktortechnik, Karlsruhe, Ger.). Nukleonik 2, 131-9(1960) June. (In German)

By using a pulsed neutron source, the absorption cross section, the diffusion constants, and the constants of diffusion cooling for thermal neutrons in water and diphenyl were determined in the temperature intervals from 22 to 80° and 20 to 180°C, respectively. The results were compared with the measurements and calculations of other authors. The sources of error of the pulse method were discussed. In addition, results of a measurement in paraffin are given. (tr-auth)

22312

THE SLOWING DOWN OF NEUTRONS IN HETEROGENEOUS ARRANGEMENTS. Gerd Blässer (Inst. für Neutronenphysik und Reaktortechnik, Karlsruhe, Ger.). Nukleonik 2, 141-4(1960) June. (In German)

The transport equation which describes the slowing down of neutrons in a heterogeneous system was reduced by solution of an auxiliary problem to an integral equation in which only the collision density in the moderator still enters in. In the first approximation a known relationship for resonance capture in heterogeneous systems is obtained. (tr-auth)

22313

THE POSITION DEPENDENCE OF THE NEUTRON TEMPERATURE IN MODERATORS. Tasso Springer (Technische Hochschule, Munich). Nukleonik 2, 144-9(1960) June. (In German)

Under the assumption of isotropic scattering, the position dependence of the neutron temperature in a moderator with a homogeneous source distribution in the vicinity of a strongly absorbing expanding plate was calculated and described. The treatment follows rigorously with respect to the neutron transport in relation to the energy spectrum under assumption of a Maxwell distribution with variable temperature. The pattern of the mean neutron temperature was calculated by utilization of the diffusion theory in the vicinity of a moderator temperature discontinuity. In the calculation the addition of the superposition of two distinct Maxwell spectra, proposed by Selengut and Kottwitz, was applied. (tr-auth)

22314

NUCLEAR INTERACTIONS OF 5.7 Bev PROTONS IN PHOTOGRAPHIC EMULSION. V. Y. Rajopadhye (Bristol Univ., Eng.). Phil. Mag. (8) 5, 537-51(1960) June.

Tracks produced by 5.7 Bev protons in nuclear emulsions were followed until they interacted with emulsion nuclei, and a mean free path of 35.6 ± 2.4 cm was obtained. About 24% of the shower tracks were found to be protons, all of which emerged at angles less than 20° with the direction of the primary. The mean multiplicity of pion production was found to be 2.6 ± 0.3, the coefficient of inelasticity 0.49 ± 0.07, and the transverse momentum of pions 220 ± 30 Mev/c. The angular distribution of the shower tracks was analyzed on the assumption that the pions were produced in a single collision system with a forward–backward symmetry in the center of mass reference frame. The mass of the particle with which the incident proton formed such a collision, was shown to have an upper limit of 1.08 ± 0.15 proton mass units. Hence the meson production on an average could be considered as arising in a nucleon–nucleon collision even with a complex target nucleus. The angular distribution of the pions in the C-system was found to be isotropic, within the limits of experimental errors. (auth)

22315

EXPERIMENTAL STUDY OF THE CRITICAL DIFFUSION

OF NEUTRONS IN IRON. M. Ericson (Centre National de la Recherche Scientifique, Paris) and B. Jacrot. Phys. and Chem. Solids 13, 235-43(1960) June. (In French)

The cross section for critical scattering of slow neutrons by iron near the Curie temperature is studied. The parameters κ_1, μ_1, Λ introduced in the Van Hove's theory are measured for various temperatures. For instance, at a temperature of 826°C ($T-T_c = 56°$) it is found: $\kappa_1^2 = 1.66 \times 10^{-2}(\text{Å})^{-2}$, $(2m\Lambda/\hbar) = 3.5$. The results for κ_1 and μ_1 disagree with the results of other authors. They are consistent with magnetic data. The results are compared with different theoretical estimations. The best fit is obtained with a model in which the second neighbors of an iron atom are magnetically active and in which the magnetic electrons are described by the Heisenberg model. (auth)

22316

SCATTERING OF SLOW NEUTRONS BY WATER. Mark Nelkin (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. 119, 741-6(1960) July 15.

The motions of hydrogen atoms in water are considered in terms of the H_2O molecule as the basic dynamical unit. Vibrations, hindered rotations, and translations of the molecule are included. For the numerical calculations, the hindrance of the translations is neglected, and the hindered rotations are replaced by a torsional oscillation with a single energy, $h\nu = 0.06$ ev. When certain approximations are made in the average over molecular orientation, this model allows for the computation of differential and total slow-neutron cross sections. The computed cross sections are in good agreement with most of the available slow-neutron scattering data. The features of the high-resolution experiments directly associated with the hindrance of the molecular translations in the liquid are not reproduced. (auth)

22317

ELECTRON PAIR PRODUCTION IN π^- + d CAPTURE. David W. Joseph (Univ. of Chicago). Phys. Rev. 119, 805-10(1960) July 15.

The internal conversion coefficient $\rho(p) = (dW_{2e}/dp)/(dW_\gamma/dp)$ relating the π^- + d capture processes yielding $2n + e^+ + e^-$ and $2n + \gamma$ is calculated as a function of the n-n relative momentum p. It is found to be a slowly varying function of p, insensitive to the strength of the n-n force. The spectrum of the electron pair energies (or of the momentum p) therefore depends sensitively on the n-n scattering length, just as Watson and Stuart found to be the case for the photon spectrum. Thus, observation of the pair production process is an alternative method of measuring the n-n scattering length. (auth)

22318

MULTIPLE MESON PRODUCTION BY PHOTONS IN HYDROGEN. B. M. Chasan, G. Cocconi, V. T. Cocconi, R. M. Schectman, and D. H. White (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 119, 811-14(1960) July 15.

The analysis of 235 events of double meson production by photons with energy up to 1.1 Bev (reaction $\gamma + p \rightarrow p + \pi^+ + \pi^-$) observed in a H_2 diffusion cloud chamber produced the following results. The cross section rises rapidly at about 500 Mev to a value of approximately 70 μb. The angular, momentum, and Q distributions of the reaction products cannot be satisfactorily accounted for either by a pure statistical model, by a pure isobaric state model, or by a model assuming interaction of the incoming photon with the meson cloud of the proton, leading to π-π interaction. The observation of 14 cases of the reactions $\gamma + p \rightarrow p + \pi^+ + \pi^- + \pi^0$ and $\gamma + p \rightarrow n + \pi^+ + \pi^+ + \pi^-$ suggests that the combined cross section for these reactions is about 10 μb between 700 and 1000 Mev. (auth)

22319

DEPOLARIZATION OF A MUON BY HYPERFINE INTERACTION. Elihu Lubkin (Univ. of California, Berkeley). Phys. Rev. 119, 815-17(1960) July 15.

The further depolarization of a muon captured in the 1s Bohr orbit by hyperfine interaction with a nucleus of spin j is calculated. The main result is that the asymmetry parameters of the decay electrons from the $J = j \pm \frac{1}{2}$ states are multiplied by respective asymmetry reduction factors $\frac{1}{3}[1 \pm 2/(2j + 1)]$. (auth)

22320

PROPOSAL FOR DETERMINATION OF $\Sigma\Lambda$ RELATIVE PARITY FROM CHEW AND LOW ANALYSIS OF REACTIONS OF THE FORM A + B → C + D + E + ... Murray Muraskin (Univ. of Illinois, Urbana). Phys. Rev. 119, 818-21(1960) July 15.

The Chew and Low analysis of reactions of the form $A + B \rightarrow C + D + E + \cdots$, which makes use of the existence of a pole in the S matrix, is used to propose an experiment to determine the $\Sigma\Lambda$ relative parity and the coupling constant for the $\Sigma\Lambda\pi$ interaction. It is found that the sign of the extrapolated cross section for the reaction $\Sigma^+ + d \rightarrow \Lambda^0 + p + p$ is different for the two parity cases. Other applications of the Chew and Low method to strange particle reactions are briefly looked into. (auth)

22321

DIFFUSIVE MOTIONS IN WATER AND COLD NEUTRON SCATTERING. K. S. Singwi and Alf Sjölander (Argonne National Lab., Ill.). Phys. Rev. 119, 863-71(1960) Aug. 1.

Using a model of liquid water in which a molecule, in its equilibrium position, performs an oscillatory motion for a mean time τ_0, and then diffuses by continuous motion for a mean time τ_1, and repeats this sort of motion, the differential scattering cross section for cold neutrons was calculated. It is found that the shape of the "quasi-elastic" scattering is, in general, not Lorentzian. The formula for the broadening of the quasi-elastic peak assumes a simple form in two limiting cases: In case (i) $\tau_1 \gg \tau_0$, it reduces to the formula derived on the simple diffusion theory; and in case (ii) $\tau_1 \ll \tau_0$, the broadening is the same as in case (i) if $\kappa^2 D\tau_0 \ll 1$, and it approaches the asymptotic value $2\hbar/\tau_0$, if $\kappa^2 D\tau_0 \gg 1$, where $\hbar\kappa$ is the momentum transferred to the system and D is the diffusion coefficient of water. The observed value of the broadening can be explained for a value of $\tau_0 = 4 \times 10^{-12}$ sec. Besides, the theoretical quasi-elastic scattering in case (ii) has certain interesting features which are in general agreement with experiment. Inelastic scattering (hindered translations only) of cold neutrons was calculated using two different models of water: (a) a gas model and (b) a Debye model. The results were compared with experiment. The general shape of both the quasi-elastic and inelastic scattering of cold neutrons and the magnitude of the diffusive broadening seem to support a quasi-crystalline model of water. (auth)

22322

ATOMIC MOTIONS IN WATER BY SCATTERING OF COLD NEUTRONS. D. J. Hughes, H. Palevsky, W. Kley, and E. Tunkelo (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 119, 872-81(1960) Aug. 1.

The inelastic scattering of cold neutrons, of energy about 4×10^{-3} ev, was used to study the atomic motions in water, mainly in the liquid phase. As a result of the incoherent nature of scattering by protons, the interpretation of the energy changes in terms of atomic motions is particularly simple. The water samples used were extremely thin in order to avoid multiple scattering effects. Instead of the

smooth distribution in energy of the scattered neutrons expected for a classical liquid, the experimental results exhibit a number of distinct energy changes. The observed transition energies are (in units of 10^{-3} ev), 61, 21, 8, 5, and 0.5. The first three of these agree with Raman spectroscopy results. The highest energy transition increases in intensity up to the boiling point, but does not shift in energy. For water vapor at 20 atm., a smooth energy distribution is obtained, which agrees well with the theory of Krieger and Nelkin. The sharp energy levels observed for liquid water indicate that the molecules do not act as free gas atoms of mass 18; in the vapor the effective mass is about 4. An elastic peak is observed that exhibits no spread in energy of the type expected from the theory of classical diffusive motions. Instead, two small but sharp peaks are found to correspond to the gain and loss of 0.5×10^3 ev energy; the nature of the transition corresponding to this energy change is unknown. The absence of diffusive broadening shows that the water molecules remain in one location for a relatively long time, about 10^{-12} sec, before undergoing diffusive "jumps." In general, the present experiments show that the atomic motions in water are similar to those in a solid rather than a gas. (auth)

22323

CLUSTER INTEGRALS AND THE GROUND STATE OF BOSONS WITH REPULSIVE INTERACTIONS. H. A. Gersch and V. H. Smith (Georgia Inst. of Tech., Atlanta). Phys. Rev. 119, 886-91(1960) Aug. 1.

The properties of a Bose system of particles with repulsive interactions were previously treated using perturbation theory in the formalism of second quantization. Others also considered this problem by dealing with the wave function in configuration space, using the theory of cluster expansions. In these latter papers, variation with respect to a parameter in a trial function for the ground state was shown to yield a ground-state energy close to the exact asymptotic expressions obtained from perturbation theory. The connection between the two methods is not immediately obvious from these cluster expansion treatments. It is shown here that the cluster integral method can be handled so that it is completely equivalent to the pair approximation in perturbation theory. (auth)

22324

SOLUBLE THREE-DIMENSIONAL MODEL FOR TOWNSEND'S α. G. W. Stuart and E. Gerjuoy (General Atomic Div., General Dynamic Corp., San Diego, Calif.). Phys. Rev. 119, 892-9(1960) Aug. 1.

A model gas is considered in which all electron-molecule cross sections are isotopic and depend inversely on the velocity v. Collisional energy loss is neglected. The Boltzmann equation for the model is solved for the collision density, where the collision density is the number of collisions that an individual electron makes between v and v + dv over its entire history. The Townsend α is obtained from the collision density, and it is found that α/p is inversely proportional to E/p. It is argued that this model furnishes an upper bound to the true α/p for all E/p; therefore it is concluded that this model demonstrates that at sufficiently high E/p the observed α/p for any real gas must decrease with increasing E/p. The results also shed light on the way electron energy balance or lack of energy balance affects α/p and the drift velocity v_D; it is shown that energy balance is not possible at arbitrarily large E/p. Numerical applications of these results to H_2 are discussed. (auth)

22325

CHARGE-EXCHANGE SCATTERING OF NEGATIVE PIONS AT 150 Mev. W. J. Kernan (Univ. of Chicago). Phys. Rev. 119, 1092-6(1960) Aug. 1.

The charge-exchange scattering of π^- by hydrogen was measured at a bombarding energy of 150 Mev. The energy distribution of gamma rays from the decay of π^0 was measured with a lead glass Cherenkov counter at laboratory angles of 45, 75, 105, and 135°. If the charge exchange differential scattering cross section in the center-of-mass system is expanded as a series of Legendre polynomials, the result is: $d\sigma/d\Omega = (1.00 \pm 0.03)[3.39 \pm 0.11 - (1.54 \pm 0.29)P_1(\cos\theta') + (3.57 \pm 0.56)P_2(\cos\theta')]$mb-sr^{-1}. The total cross section for charge exchange, obtained by integration, is then $\sigma_{tot}(\pi^- \rightarrow \pi^0) = 42.6 \pm 1.9$ mb. (auth)

22326

CHARGE-EXCHANGE SCATTERING OF NEGATIVE PIONS AT 61 Mev AND 95 Mev. C. M. York, W. J. Kernan, and E. L. Garwin (Univ. of Chicago). Phys. Rev. 119, 1096-9(1960) Aug. 1.

The charge-exchange scattering of negative pions by liquid hydrogen was measured at 61 ± 1 and 95 ± 2 Mev bombarding energy. The measurements were made with a gamma spectrometer which employs a lead glass Cherenkov counter. If the charge exchange scattering cross section is expanded as a series of Legendre polynomials in the center-of-mass system of the collision, it is found that at 61 Mev, $d\sigma/d\Omega = (1.00 \pm 0.05)[0.613 \pm 0.030 - (0.830 \pm 0.068)P_1(\cos\theta') + (0.183 \pm 0.150)P_2(\cos\theta')]$, and at 95 Mev, $d\sigma/d\Omega = (1.00 \pm 0.03)[1.05 \pm 0.05 - (1.15 \pm 0.12)P_1(\cos\theta') + (0.33 \pm 0.25)P_2(\cos\theta')]$. The total cross section for charge exchange, obtained by integration, is: $\sigma_{tot}(\pi^- \rightarrow \pi^0) = 7.7 \pm 0.6$ mb at 61 Mev and $\sigma_{tot}(\pi^- \rightarrow \pi^0) = 13.2 \pm 0.8$ mb at 95 Mev. A table summarizing the measurements performed at 61, 95, 128, and 150 Mev is given. (auth)

22327

K^--DEUTERON SCATTERING AND THE K^--NUCLEON SCATTERING LENGTHS. T. B. Day, G. A. Snow, and J. Sucher (Univ. of Maryland, College Park). Phys. Rev. 119, 1100-2(1960) Aug. 1.

Cross sections for K^--d reactions were calculated in the low-momentum region for several possible values of the elementary $\bar{K}$-nucleon scattering amplitudes. Multiple-scattering effects were included in an approximate way. A comparison of the results for the sum of the elastic plus breakup cross sections with the preliminary measurements available is presented. (auth)

22328

GAUGE INVARIANCE AND THE LORENTZ PONDERMOTIVE FORCE. Lloyd Motz (Columbia Univ., New York). Phys. Rev. 119, 1102-5(1960) Aug. 1.

If one introduces into the Weyl theory of gauge invariance the two additional conditions that gauge (and therefore length), except for an arbitrary phase factor, be integrable along the path of a particle, and that the change in dimensions of a particle be a minimum, one immediately obtains the Lorentz pondermotive force for a charged particle in an electromagnetic field and the Bohr-Sommerfeld quantum integral. (auth)

22329

ELECTROMAGNETIC FORM FACTORS OF THE NUCLEON. F. J. Ernst (Univ. of Wisconsin, Madison) R. G. Sachs, and K. C. Wali. Phys. Rev. 119, 1105-14(1960) Aug. 1.

The physical interpretation of the electromagnetic form factors is discussed with special reference to the gauge invariance of particular theories. A distinction is made between the condition that the one nucleon matrix element

satisfy the equation of continuity ("weak gauge invariance") and the stronger condition imposed by the generalized Ward identity ("strong gauge invariance"). The former is shown to be a consequence of covariance under the improper Lorentz transformations, and hence it has no new content concerning the functional behavior of the form factors. The latter implies restrictions on the current operator which may have an important effect on the results of calculations of form factors. In connection with the physical interpretation, it is noted that the moments of the charge and current distribution are determined by $F_{ch} = F_1 - (q^2/2M)F_2$ and $F_{mag} = (1/2M)F_1 + F_2$. Specifically the second moment of the charge distribution, $-6F_{ch}'(0)$, is found, in the case of the neutron, to be directly measured by the neutron-electron interaction without the intervening subtraction of the Foldy term. These matters are investigated in detail by means of a specific model of the nucleon which is a covariant generalization of the fixed source static model having the property that it gives results identical with the static model in the limit $M \to \infty$. It is found that strong gauge invariance requires the addition of line currents which make significant contributions to the form factors in general and, in particular, to the proton charge radius even in the static approximation. This suggests that as a consequence of strong gauge invariance, important contributions to the charge radius must arise in any theory from intermediate states of large mass. The model also provides a means of consistently calculating recoil corrections to the static model. They are found to be large. (auth)

22330

PION-PION SCATTERING AND $K^{\pm} \to 3\pi$ DECAY. N. N. Khuri (Inst. for Advanced Study, Princeton, N. J.) and S. B. Treiman. Phys. Rev. 119, 1115-21(1960) Aug. 1.

The effects of final state π-π interactions on the spectrum of $K^{\pm} \to 3\pi$ decay were studied by dispersion relation methods. In the approximations adopted a set of linear integral equations were used for finding the amplitudes of the $K^{\pm} \to 3\pi$ decay. The kernels in these equations depend on the π-π S-wave scattering amplitudes. An approximate solution for these equations was obtained by iteration and the departures from a purely statistical spectrum for the decay are related to π-π S-wave scattering. The latter in turn was assumed to be well represented with a scattering length structure. The $K^{\pm} \to 3\pi$ spectrum then was parametrized by two quantities, the T = 0 and T = 2 π-π S-wave scattering lengths, a_0 and a_2. Such experimental results as presently exist indicate that $a_2 - a_0$ is positive and that roughly $a_2 - a_0 \approx 0.7$, in units of the π Compton wavelength. (auth)

22331

CATENARY METHOD FOR PLOTTING TRAJECTORIES OF RELATIVISTIC AND ULTRARELATIVISTIC PARTICLES IN ELECTROSTATIC FIELDS. A. M. Strashkevich. Radiotekh. i Elektron. 5, 1118-23(1960) July. (In Russian)

Descriptions and explanations are given by the catenary (grapho-analytical) method plotting the trajectories of charged relativistic and ultrarelativistic particles. (tr-auth)

22332

THE MEAN LIFETIME RATIO OF K MESON AND HYPERONS IN THE BRANCHING RATIOS OF DIFFERENT DECAY MODES. W. T. Lee, D. C. Sen, T. H. Ho, J. M. Chen, and H. Y. Tzu (Inst. of Atomic Energy Research, Academy of Sciences, China). Sci. Record (Peking) 3, No. 1, 35-9(1959). (Translated from Referat. Zhur. Fiz. No. 11, 1959, abstract No. 24427).

The decay branching ratios of Λ, Σ, and K were investigated assuming V-A interaction. The strong interactions were considered in the lower order perturbation theory with the introduction of a cut-off factor. (W.D.M.)

22333

SOME TOPICS IN COULOMB SCATTERING. Pure and Applied Mathematics and Physics 7. Bengt Nagel (Royal Inst. of Tech., Stockholm). Trans. Roy. Inst. Technol., Stockholm No. 157, 1-30(1960).

A generalization of the Born approximation, using three-dimensional Coulomb wave functions as unperturbed solutions, is applied to a study of various Coulomb scattering problems. The influence of vacuum polarization on proton-proton scattering, and relativistic Coulomb scattering of Klein-Gordon and Dirac particles are included. (auth)

22334

MULTIPLE-PLURAL MESON PRODUCTION PROCESS. P. A. Usik. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 1-16(1960). (In Russian)

Several variations in the theory of meson production in high-energy nucleon interactions with nuclei are analyzed using the system of units h = c = M = 1 (M is nucleon mass). The phenomenological theory of multiple production processes is presented as a different approach to the theory of nucleon interaction with complex nuclei. Correlations of the theory with experiments on multiplicity of cascade particles are made. It is shown that the suggested phenomenological theory of meson formation in nucleon collisions with complex nuclei is in good agreement with experiments at energies from 1 to ~1000 Bev. (R.V.J.)

22335

DETERMINATION OF THE ENERGY OF CHARGED PARTICLES IN NUCLEAR PHOTOEMULSION. I. Ya. Chasnikov. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 64-88(1960). (In Russian)

A method is suggested for excluding all pseudo-scattering and finding the true Coulomb scattering by means of difference coordinates. Data on multiple scattering of accelerated particles and on cosmic radiation particles up to 10 Bev confirm the feasibility of the suggested method. Energies of 25 Bev were assigned to shower particle tracks of several centimeters in length. (R.V.J.)

22336

APPLICATIONS OF MONTE-CARLO METHOD FOR CALCULATIONS OF γ QUANTA PASSING THROUGH A SUBSTANCE. A. F. Akkerman and D. K. Kaipov. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 106-14(1960). (In Russian)

Correlations of data obtained by Monte Carlo calculations and experimental data confirm the efficiency of the Monte Carlo method for γ penetration. Applications of computers permitted rapid computations of γ trajectories and offered highly accurate resolution to a series of analytical problems. (R.V.J.)

22337

RESONANCE INTERACTIONS IN STATISTICAL THEORY OF MULTIPLE PARTICLE PRODUCTION. V. I. Rus'kin. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 131-41(1960). (In Russian)

Indirect data taken during experiments with resonance interactions are considered within the framework of multiple particle production. Considerations of Fermi statistical theory for resonance (π-π) interactions along with nucleon "isobar" ($^3/_2$, $^3/_2$) interactions explain nearly all the characteristics of π^--ρ interactions at 1 Bev. (R.V.J.)

22338

OPTICAL MODEL OF MESON FORMATION AT HIGH EN-

ERGIES. D. P. Leper. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 142-9(1960). (In Russian)

A quantum mechanical model describing angular distribution is developed as a supplementary model in the theory of multiple meson production. Angular distributions of mesons and transverse pulses obtained by the above model are in good agreement with experimental data. (R.V.J.)

22339

MESON PROPERTIES IN HEISENBERG THEORY. Ya. I. Granovskiĭ. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 157-63(1960). (In Russian)

The Heisenberg elementary particle theory was applied in studies of the properties of elementary particles for the purpose of finding conclusions which could be correlated with experimental data. Meson spin, parity, and mass are taken as criteria for the analysis. The calculations did not consider the isotropic properties of ψ field; thus the isotropic properties of mesons remained unknown. The scalar variation, considering isotopic properties of ψ, reduces pseudoscalar meson mass, bringing it closer to experimental data. The lagrangian cannot be utilized for strange particle theory. Calculations of a realistic model show good agreement and approaches within ~3% of the K meson mass. For the meson mass, disagreement with experimental values is ~20%. (R.V.J.)

22340

ON DIFFRACTION SPLITTING OF DEUTERONS. A. G. Sitenko and V. K. Tartakovs'kiĭ. Ukraïn. Fiz. Zhur. 4, 708-23(1959) Nov.-Dec. (In Ukrainian)

The distribution of neutrons and protons released during diffraction splitting of deuterons was determined by angles and energies. The distribution by energies is found for the products of the diffraction splitting of the deuteron in the center of inertia system and the laboratory system. In the laboratory system in which the nucleus was at rest before the collision, the energetic distribution is distinguished by a sharp maximum with an energy of the free particles equal to half the energy of the incident deuteron. The angular distribution of particles released during the diffraction splitting of the deuteron is found; it is characterized by an acute forward directivity. The curve of angular correlations between neutrons and protons is determined. The diffraction splitting of the deuteron may be detected experimentally by determining the energetic spectra, as well as the angular correlation between neutrons and protons arising during the interaction of deuterons with nuclei. The distribution of nuclei by output pulses during diffraction splitting of deuterons is determined. Consideration for the spin-orbital interaction of the neutron and proton with the nucleus leads to the setting up of polarization. In the region of small angles the polarizations of the released neutrons and protons are opposite in sign to the polarization arising on scattering of free neutrons and protons on nuclei. (auth)

22341

ABOUT THE ROLE OF A FORM FACTOR IN THE DISINTEGRATION $\pi^0 \rightarrow \gamma + e^+ + e^-$. D. V. Volkov and V. M. Oraevs'kiĭ (Physico-Technical Inst., Academy of Sciences, Ukrainian SSR). Ukraïn. Fiz. Zhur. 4, 804-6(1959) Nov.-Dec. (In Ukrainian)

An investigation is described in which a form factor was considered for the interactions in the disintegration $\pi^0 \rightarrow \gamma + e^+ + e^-$. A Lagrangian involving a form factor, $f(q^2)$, was written (where q is impulse) as follows: $L = \eta\varphi EHf(q^2)$, where η is the effective coupling constant; φ, E, and H are operators of the meson and electromagnetic fields; q is the 4-impulse of the virtual photon and $f(q^2)$ is the real function normalized in such a way that $f(0) = 1$. From this an expression for $\omega(x)dx$ involving the form factor was written. The form factor is expressed as $f(-x^2) = 1 - a(x^2)/(\mu^2)$ where "a" is an unknown. An expression for ω, including this unknown, was then derived. Since the expression for $\omega\pi^0 \rightarrow 2\gamma$ is known, the ratio $(\omega\pi^0 \rightarrow \gamma + e^+ + e^-)/(\omega\pi^0 \rightarrow 2\gamma)$ may be written. This ratio has been measured and therefore the value of "a" can be obtained. This was found to be $a = 1.4 \pm 3.0$. The error of measurement is high at present but more accurate experiments will make it possible to determine the role of the form factor in this process with more precision. (TTT)

22342

THE SCATTERING OF ELECTRONS ON PROTONS IN THE SECOND BORN APPROXIMATION AT INCIDENT ENERGIES OF APPROXIMATELY 100 Mev. Günther Meyer (Universität, Marburg, Ger.). Z. Naturforsch. 15a, 548 (1960) May-June. (In German)

The correction term of the second Born approximation of the scattering of electrons on protons was derived on the assumption that the electrodynamic structure of the proton caused by the charged meson field could be neglected. The results of a numerical evaluation are graphed. (J.S.R.)

22343

ON THE π MESON PRODUCTION IN π-N INTERACTIONS. A. I. Lebedev and V. A. Petrun'kin (Lebedev Inst., Moscow). Zhur. Eksptl'. i Teoret. Fiz. 38, 1337-9(1960) Apr.

The measured distribution of π mesons from the reaction $\pi + N \rightarrow 2\pi + N$ at 1.0 and 1.4 Bev is described only qualitatively by a model which indicates that the supplementary meson is produced only through the formation of an isobar state ($T = 3/2$, $I = 3/2$, $l = 1$) with finite width. The Fermi statistical theory does not explain these distributions while considerations, within the theory, of the isobar as a particle with a definite mass $M = 1.32$ (in units of nucleon mass) also results only in qualitative agreement with the experiment. A correlation considering a possible resonance $\pi-\pi$ interaction with a new particle with mass $M = 0.47$ which decays into π mesons showed better agreement with experiment. An attempt is made to show that satisfactory description of the experimental data can be achieved in statistical theory without considering meson-meson interactions. The finite width of isobar decay is considered in calculating π meson spectra produced by the decay. The finite state of $\pi + \pi + N$ is examined as a $\pi-N$ interaction. The total cross section of $\pi + N \rightarrow 2\pi + N$ is expressed as $d\sigma = C_1 d\sigma_1 + C_2 d\sigma_2$, where $d\sigma_2$ is the cross section for the three particles without interaction and C_1 and C_2 are determined by the statistical weights for π meson and isobar ($M = 1.32$) and two π meson and nucleon production; $d\sigma_1$ and $d\sigma_2$ are normalized for the same number of mesons. (R.V.J.)

22344

ON THE Σ-HYPERON DECAY. Kuang-chao Chou (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1342-3(1960) Apr. (In Russian)

Experimental data on probabilities and coefficients of asymmetry for Σ hyperon decay along different channels satisfy the rule $[\Delta I] = 1/2$. If the rule $[\Delta I] = 1/2$ is confirmed by the experiments, then the universal theory of weak interactions between charged particles will not hold. The amplitudes of $\Sigma^+ \rightarrow p + \pi^0$, $\Sigma^+ \rightarrow n + \pi^+$, and $\Sigma^- \rightarrow n + \pi^-$ are expressed by A_+, A_0, and A_-, where $A = a + ib\,(\sigma K)$, K is single vector in the direction of nucleon motion. The lack of asymmetry in $\Sigma^\pm \rightarrow n + \pi^\pm$ decay means that for the above processes $Re(ab^*) = 0$. Three variations satisfy these conditions: $a = 0$; $b = 0$; a and b differ in phase at 90°. Measurements of the direction of the nucleon polarization vector offers verification for $[\Delta I] = 1/2$ and aid in the

selection of a solution for two possible conditions ($a_0 = b_- = 0$ or $a_0 = b_0 = 0$). In the event transverse neutron polarization is absent in Σ^- decay, the initial Σ^- is non-polarized, and the absence of asymmetry in the decay does not result in the equation $Re(ab^*) = 0$. The magnitude of $Re(ab^*)$ is determined by measuring the longitudinal neutron polarization. (R.V.J.)

22345

ON THE PROCESS $e^- + p \rightarrow \Lambda + \nu$. V. M. Shekhter (Leningrad Inst. of Physics and Tech., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1343-5(1960) Apr. (In Russian)

The process $e^- + p \rightarrow \Lambda + \nu$ may be considered a reverse Λ-hyperon β decay, yielding considerably larger statistics. The threshold for $e^- + p \rightarrow \Lambda + \nu$ in the laboratory system is $(m^2\Lambda - m^2p)/2m_p = 194$ Mev up to the photoproduction threshold for $\Lambda(e^- + p \rightarrow e^- + \Lambda + K^+)$ of $(m_\Lambda + m_K)^2 - m_p^2/2m_p = 912$ Mev. Λ hyperons are produced only in this reaction or in $e^- + p \rightarrow \Sigma^0 + \nu$; $\Sigma^0 \rightarrow \Lambda + \gamma$. An experimental analysis of $e^- + p \rightarrow \Lambda$ permits a determination of form factors as functions of Q^2. The reactions $e^- + p \rightarrow \Sigma^0 + \nu$ and $e^- + n \rightarrow \Sigma^- + \nu$ can be analyzed along with the reaction $e^- + p \rightarrow \Lambda$, while analogous processes with μ^- instead of e^- cannot be analyzed due to the lack of an intense μ^- flux. (R.V.J.)

22346

INELASTIC INTERACTIONS OF 9 BEV PROTONS WITH FREE AND BOUND NUCLEONS IN PHOTOEMULSION. N. P. Bogachev, S. A. Bunyatov, Yu. P. Merekov, V. M. Sidorov, and V. A. Yarba (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1346-8 (1960) Apr. (In Russian)

Multiple Coulomb scattering and ionization were measured in order to obtain the energy and angular characteristics of secondary particle tracks at 5° to the emulsion plane. 144 tracks from p-p events and 108 tracks from p-n events were recorded. The mean magnitude of the spurious scattering layer was 0.3μ for a 1000μ emulsion and 0.7μ for a 2000μ emulsion, corresponding to Coulomb scattering of single-charge particles with $p\beta = 5$ Bev/c. All secondary particles with $p\beta < 1.6$ Bev/c were identified. Curves showing ionization dependence on $p\beta$ for π mesons and protons are overlapping in the region of higher $p\beta$ magnitudes. It is shown that $p\beta < 1.6$ Bev/c composes 78% of the total number of particles. The angular distribution of charged π mesons and protons, the proton and charged π meson pulse spectra, and the angular distribution of secondary particles in p-p and p-n interactions are plotted. The angular distribution of p-p interactions is symmetric, while for p-n it is asymmetric. The asymmetry coefficients are $\Delta pp = 0.08 \pm 0.36$, $\Delta pn = 1.05 \pm 0.32$. The asymmetry cannot be explained by statistical theory. Neither can the experimental data on N-N interactions at 6 to 9 Bev be described by multiple production statistical theory. The data on the spectra of secondary protons and mesons do not contradict the postulation of the importance of collisions with small momentum transfer (peripheral collisions). (R.V.J.)

22347

ON THE PRODUCTION OF $\bar{\Sigma}^-$ HYPERON BY NEGATIVE π^- MESONS WITH ENERGY OF 8.3 Bev/c. Kang-chang Wang, Ts'u-tseng Wang, V. I. Veksler, N. M. Viryasov, I. Vrana, Ta-ts'ao Ting, Ki-in Kim, E. N. Kladnitskaya, A. A. Kuznetsov, A. Mikhul, Din-ty Nguen, A. V. Nikitin, and M. I. Solov'ev (Joint Inst. for Nuclear Research, Dubna, USSR). Zhur. Eksptl'. i Teoret. Fiz. 38, 1356-9 (1960) Apr. (In Russian)

An event of $\bar{\Sigma}^-$ production was observed among 40,000 pictures taken of 8.3 ± 0.6 Bev/c π^- interactions in a propane chamber with a constant magnetic field of 13,700 gauss. The picture and scheme of the event are shown. At the zero point the π^- forms a star of four prongs with high energies. The more probable reaction in the first star is considered to be $\pi^- + C \rightarrow \bar{\Sigma}^- + K^0 + \bar{K}^0 + K^- + p + \pi^+ + \pi^- +$ recoil nuclei. The lifetime of $\bar{\Sigma}^-$ is $(1.18 \pm 0.07) \times 10^{-10}$ sec. (R.V.J.)

Nuclear Properties and Reactions

22348 BNL-605

Brookhaven National Lab., Upton, N. Y.

TABLE OF GAMMA-RAYS EMITTED BY RADIOACTIVE NUCLEI ARRANGED IN ORDER OF INCREASING ENERGY. E. der Mateosian and M. McKeown. May 1960. 236p. OTS.

Data were taken principally from two sources: the Table of Isotopes by D. Strominger and the Nuclear Data Sheets. To facilitate comparison of the data, all gamma rays reported in these sources for a particular nuclide were plotted on an energy scale under the names of the experimentalists responsible for the measurements. Only a very limited critical evaluation of the data was attempted. (W.D.M.)

22349 KAPL-M-DCS-4

Knolls Atomic Power Lab., Schenectady, N. Y.

THE TOTAL ENERGY RELEASE PER FISSION OF U^{235} AND ITS TIME DEPENDENCE. D. C. Sherman. June 15, 1960. 22p. Contract W-31-109-Eng-52. OTS.

The published data on energy release per U^{235} fission are reviewed and supplemented with calculated neutron capture energy to establish a total sensible energy release of 200 ± 6 Mev per fission in pressurized water reactors corresponding to $(3.12 \pm .10) \times 10^{10}$ fissions required to produce one watt-sec. of heat. The time dependence of the delayed portion of this energy is given by infinite-period-at-constant-power curves which can be used to estimate power response to step changes in neutron flux level or the decay power for arbitrary, finite, reactor power histories. (auth)

22350 NP-8814(p.1-5)

Naval Research Lab., Washington, D. C.

NUCLEAR CONSTITUENTS AND STRUCTURE. Some Remarks on the Physical Interpretation of Pauli's Transformation. E. J. Schremp.

The underlying identity of content that subsists between a previous treatment of isotopic spin and a more recent one of Gürsey is shown. It is concluded that the net effect of Gürsey's exposition was a misinterpretation of the intrinsic physical significance of Pauli's transformation. (W.D.M.)

22351 NP-8895

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

β^+ RADIATION OF Pr^{140}. (Widmo Pozytonow Pr^{140}). Report No. 148/I-A. S. Chojnacki, J. Kopystyński, Z. Preibisz, R. Sosnowski, I. Yutlandov, and J. Żylicz. Apr. 1960. 8p.

The positon spectrum of Pr^{140} was investigated with a long lens magnetic β-ray spectrometer. The helical baffles were applied to separate the positons and electrons. The maximum energies of three β^+ components are 2366 ± 12, 770 ± 12, and 458 ± 15 kev and their relative intensities: 1; $<1.4 \times 10^{-2}$; and 7.2×10^{-6}. (auth)

22352 NP-8929

Illinois. Univ., Urbana.

MÖSSBAUER EFFECT. RECOILLESS EMISSION AND AB-

SORPTION OF GAMMA RAYS. [PROCEEDINGS OF MEETING HELD AT] UNIVERSITY OF ILLINOIS, JUNE 6 AND 7, 1960. Hans Frauenfelder and Harry Lustig, eds. 80p. Contract AF18(603)-49. (AFOSR-TN-60-698).

An informal meeting on the Mössbauer effect was held at Allerton House, University of Illinois, on June 6 and 7, 1960. Topics covered included theory, isotopes, experiments, relativity, nuclear applications, chemical shifts, line width internal fields, impurities, resonance experiments and ultrasonics, and Raleigh scattering. (W.D.M.)

22353 NYO-9087

Rochester, N. Y. Univ.

THE p-n CROSS SECTIONS ON Ti^{47}, V^{51}, Cr^{52}, Co^{59} AND Cu^{63} FROM 4 TO 6.5 MEV. H. Taketani and W. Parker Alford. June 15, 1960. 17p. Contract AT(30-1)-875. OTS.

Absolute (p,n) cross sections were measured for Ti^{47}, V^{51}, Cr^{52}, Co^{59}, and Cu^{63} at energies between 4 and 6.5 Mev. These data plus earlier measurements of the cross section for inelastic proton scattering were used to estimate total proton absorption cross sections for V^{51} and Co^{59}. An optical model calculation using parameters giving a good fit to elastic scattering measurements predicts an absorption cross section in good agreement with the measurements for Co^{59}. For V^{51}, some sets of parameters gave good agreement with the measured absorption cross section, but the fit to the elastic scattering data was only fair. (auth)

22354 TID-6238

General Atomic Div., General Dynamics Corp., San Diego, Calif.

GROSS FISSION PRODUCT CROSS SECTIONS. R. T. Shanstrom. July 30, 1958. 6p. Project No. 40.1. Contract AT(04-3)-187. (GAMD-444). OTS.

Data on fission products of U^{233}, U^{235}, and Pu^{239} are given. The fission products are divided into groups such as those with cross sections less than 10,000 barns, those with cross sections greater than 10,000 barns, and those with unknown cross sections. A gross cross section is given for the group 1 at fluxes of 10^{13}, 10^{14}, and 10^{15} n/cm^2 sec. Yield values are also given for group 2 and 3 fission products. (J.R.D.)

22355 UCRL-9190

California. Univ., Berkeley. Lawrence Radiation Lab.

FISSION OF GOLD WITH 112-Mev C^{12} IONS: A YIELD-MASS AND CHARGE-DISTRIBUTION STUDY (thesis). H. Marshall Blann. May 23, 1960. 76p. Contract W-7405-eng-48. OTS.

Fission product cross sections were measured radiochemically and mass-spectrometrically for gold bombarded with 112-Mev C^{12} ions. Cross sections for 43 nuclides were measured for elements from nickel to barium. Thirty-six yields are either primary fission product yields (independent yields) or were corrected (with less than 25% correction) so as to represent independent yields. The independent yields were empirically systematized and a yield-mass curve was constructed. The yield-mass curve is compared with the yield-mass curves obtained from the fission of Bi with 22 and 190-Mev deuterons. The yield systematics indicate that the sum of the mass numbers of complementary fission products is 13 ± 1 amu less than that of the compound nucleus, and the sum of the charges of complementary fission products is two units less than that of the compound nucleus. It is postulated that 9 ± 1 neutrons and an alpha particle must have been emitted. Evidence is presented that at least three and possibly more of the neutrons are emitted prior to fission. The most probable charge of the fission products as a function of mass number was determined empirically. It is shown that from mass number 80 to mass number 111 the Equal Charge Displacement (ECD) and Constant Charge Ratio (CCR) rules predict the empirical values equally well. For masses less than 80 and greater than 120 the ECD and CCR rules are shown to be equally poor, as the empirical distribution is between them. The Minimum Potential Energy theory of charge distribution proposed by Present and modified and interpreted by Swiatecki is shown to predict the empirical points over the entire mass region studied ($A = 66$ to $A = 135$) within experimental error (± 0.2 charge unit). (auth)

22356 CEA-tr-R-798

DÉTERMINATION SPECTROSCOPIQUE DU SPIN NOYAV DU ^{176}Lu. (Spectroscopic Determination of the Spin of Lu^{176}). N. I. Kaliteevskii and M. P. Chaika. Translated into French from Doklady Akad. Nauk S.S.S.R. 126, 57-8 (1959). 7p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 15617.

22357 CP-2250

SPONTANEOUS FISSION OF URANIUM. L. I. Rusinov. Translated by E. Rabinowitch from Uspekhi Khim. 10, 662-70(1941). 11p. (AEC-tr-799). JCL or LC.

Attempts to observe spontaneous fission of uranium are discussed; not till 1940 was it done (by Petrzhak and Flerov). A review of theories on spontaneous fission is given up to 1941. The question of which of the isotopes of uranium is responsible for its fission is examined, and it is concluded on theoretical grounds that it is U^{234}. The implications of fission in gastrophysics and geology are discussed. (D.L.C.)

22358

THE FINE STRUCTURE OF α RAYS. A. Săndulescu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 9-12(1960). (In Rumanian)

By utilizing the formulation of the theory of α decay given by Thomas by virtue of the formal theory of nuclear reactions, a demonstration of the Bohr, Fröman, and Mattelson formula is presented which connects the fine α structure of odd nuclei to that of even nuclei. The expression of the nuclear factor c_1 is deduced which permits the determination of the intensities of the fine α structure of even-even nuclei. (tr-auth)

22359

THE REDUCED LENGTHS OF THE EMISSION OF THE TRITON OR HELIUM-3 IN THE SHELL MODEL OF THE NUCLEUS. A. Săndulescu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 19-34 (1960). (In Rumanian)

The emission of a triton or helium-3 from a complex nucleus described by the shell model of the nucleus was studied. This system appears in the reactions which are produced by the intermediary of the compound system. The analytical expressions of the reduced lengths are obtained in the case where, outside of the closed shell, there are n equivalent nucleons and in the special case where there is a single nucleon. Each expression is obtained for the two extreme couplings L-S and j-j of the shell model. Comparison with experimental data is made in the reactions $He^5 \rightarrow T^3 + D^2$ and $Li^5 \rightarrow He^3 + D^2$. (tr-auth)

22360

TOTAL CROSS SECTION OF ARSENIC FOR NEUTRONS IN THE ENERGY RANGE FROM 0.01 TO 0.1 EV. D. Dragomirescu, St. Apostolescu, V. Mateiciuc, and M. Begliu.

Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 77-81(1960). (In Rumanian)

By utilization of the time-of-flight spectrometer at the Institute of Atomic Physics, the total cross section of arsenic for neutrons was determined as a function of energy in the range from 0.01 to 0.1 ev. The arsenic sample contained 3.3706 g/cm^2. The experimental data permitted the calculation of the total cross section by the equation $\sigma = 0.966\ E^{-1/2} + 3.75$ barns. The value of 9.83 ± 1.14 b was found for 0.0253 ev. (tr-auth)

22361

COULOMB EXCITATION OF Ta^{181} BY 5.5 AND 6.5 MEV PROTONS. N. Martalogu, E. Ivanov, and D. Plostinaru. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 273-84(1960). (In Rumanian)

The effects of the bombardment of Ta^{181} by 5.5- and 6.5-Mev protons were studied. The choice of these energies was made in order to obtain new results in connection with the problem of Coulomb excitation of some high-energy levels with respect to experiments made with particles accelerated in linear accelerators. Two primary excited levels of Ta^{181} were obtained (for 136 kev, I = 9/2+ and for 303 kev, I = 11/2+). Two gamma radiations at 368 and 503 kev were also obtained, and they were explained in the following manner. It is possible that, as a result of the bombardment, Ta^{181} is excited to a level higher than 503 kev which can be identified with the calculated level at 499 kev, I = 13/2+. The two radiations appear because of the de-excitation on the levels 9/2+ and 7/2+. The 368-kev radiation can be produced by the reaction $Ta^{181}(p,n)W^{181*}$. The first interpretation is considered as doubtful because the transition to such a level would be of the M3 or E4 type and would have a very small probability with respect to the common E2 transitions. The condition in which the excited state of W^{181} was detected leads to the belief that with high bombardment energies higher excitation levels of W^{181} could be obtained. (tr-auth)

22362

LOW ENERGY γ RAYS EMITTED DURING THE CAPTURE OF THERMAL NEUTRONS BY As^{75}. M. Cristu, V. Cojocaru, D. Dorcioman, and D. Dragomirescu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 357-62(1960). (In Rumanian)

The γ rays emitted during the capture of thermal neutrons by As^{75} were studied with a scintillation spectrometer in the low-energy range. Energies of 450 ± 10, 403 ± 13, 311 ± 8, 249 ± 8, 205 ± 4, and 172 ± 4 kev were found. (tr-auth)

22363

STUDIES OF NEUTRON-PROTON SCATTERING IN NUCLEAR EMULSIONS. I. ANGULAR DISTRIBUTION OF PROTONS BACK SCATTERED BY NEUTRONS OF THE REACTION $Li^7(d,n)Be^8$. J. Aguilar, M. de la Cuadra, and R. Font (Facultad de Ciencias, Valencia). Anales real soc. espaň. fís. y quím. (Madrid), Ser. A 56, 71-6(1960) Mar.-Apr. (In Spanish)

The angular distribution of neutron-proton scattering was measured at neutron energies from 1 to 15 Mev using nuclear emulsions. The results up to 10 Mev are consistent with isotropic scattering in the center-of-mass system. At higher energies, the small number of tracks makes it impossible to obtain good statistics. (auth)

22364

NEUTRON CAPTURE CROSS SECTIONS IN THE Kev REGION. PART I. METHODS OF MEASUREMENT AND ANALYSIS. E. G. Bilpuch (Duke Univ., Durham, N. C.), L. W. Weston, and H. W. Newson. Ann. Phys. (N. Y.) 10, 455-76(1960) Aug.

The relative capture cross sections in the neutron energy range from three to two hundred kev for Au^{197}, Pt^{196}, and U^{238} were measured with the beta activation technique. After normalization, the capture cross sections of Au^{197} and U^{238} were analyzed for the p-wave parameters, $(\bar{\Gamma}_\gamma/D_0)_p$ and $\bar{\Gamma}_n^{(1)}/D$. For Au^{197} it was found that the relation $(\bar{\Gamma}_\gamma/D_0)_p = (\bar{\Gamma}_\gamma/D_0)_s$ was consistent with the experimental data. In the case of U^{238}, $(\bar{\Gamma}_\gamma/D_0)_p = 2.6\ (\bar{\Gamma}_\gamma/D_0)_s$. This relation can be explained qualitatively by considering parity effects in the shell model. The p-wave strength functions consistent with the experimental data were $\bar{\Gamma}_n^{(1)}/D = 0.33 \times 10^{-4}$ and $\bar{\Gamma}_n^{(1)}/D = 0.7 \times 10^{-4}$ for Au^{197} and U^{238}, respectively. Techniques of measurement and analysis are described. (auth)

22365

NEUTRON CAPTURE CROSS SECTIONS IN THE Kev REGION. PART II. SPIN-ORBIT COUPLING AND THE OPTICAL MODEL. L. W. Weston, K. K. Seth, E. G. Bilpuch, and H. W. Newson (Duke Univ., Durham, N. C.). Ann. Phys. (N. Y.) 10, 477-89(1960) Aug.

An intensive study of average neutron capture cross sections of nuclei with $75 \leqq A \leqq 130$ was carried out in the neutron energy region 3 to 200 kev, using the activation method. Assuming s-wave parameters within the limits of error specified by low-energy total cross section determinations, the data were analyzed for corresponding p-wave parameters: the neutron strength function $\bar{\Gamma}_n^{(1)}/D$ and the γ-ray strength function $\bar{\Gamma}_\gamma/D_0$. It was found the s- and p-wave γ-ray strength functions were the same within the rather large limits of experimental error for the odd A targets: Rh^{103}, Ag^{107}, Ag^{109}, In^{115}, I^{127}, and As^{75}. The even-even isotopes of Pd and Mo were more complicated in this respect. The p-wave neutron strength functions $\bar{\Gamma}_n^{(1)}/D$ derived from the analysis of these capture cross sections were found to be in agreement with $\bar{\Gamma}_n^{(1)}/D$ as obtained from the analysis of neutron total cross sections. These strength functions exhibited a broad, double-peaked, distribution around A = 100 instead of the single peak predicted by the simple optical model. The experimental results may be explained by the addition of a small spin-orbit part to the optical potential. The parameters of the square well optical potential $V^* = V_0[1 + i\xi + \delta/2\{-1 \pm (2l + 1)\}]$ which were found to fit the p-wave strength functions best were V_0 = 41 Mev, $\xi = 0.02$, $\delta = 0.085$, and $R = 1.45\ A^{1/3}$ fermis. (auth)

22366

CALCULATION OF ACTIVITY OF AN Au^{198} FOIL FROM $\beta-\gamma$ COINCIDENCE MEASUREMENT. Dominique Roux (Laboratoire de Recherches Nucléaires, Institut de Physique, Geneva). Arch. sci. (Geneva) 12, 679-81(1959) Oct.-Dec. (In French)

An expression is derived from the decay scheme for Au^{198}: $N_\gamma^* \cdot N_\beta^*/N_c^* = (1 + \alpha)N$ where N represents the activity sought. Alpha is evaluated according to the branching ratios, thickness of the crystal detectors, and the selection of the energy threshold in the gamma channel. According to the experimental conditions and the branching ratios, $0.010 > \alpha > 0$. (T.R.H.)

22367

THE EMPIRICAL MATRIX ELEMENT OF THE M4 TRANSITION IN Xe^{135}. Torsten Alväger (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 17, 521-34(1960). (In English)

The M4 transition in Xe^{135} was investigated by use of electromagnetically isotope separated samples. The measured energy of the transition is 527.4 ± 0.8 kev and the half life 15.8 ± 0.4 min. The empirical matrix element of the M4 transition is found to be equal to those of the other known M4 isomers in Xe, except Xe^{129m}. (auth)

22368

ON THE POSSIBILITY OF THE DETECTION OF DOUBLE QUANTUM EMISSION IN ATOMIC NUCLEI, WITH SPECIAL APPLICATION TO THE DECAY OF Xe^{131m}. Torsten Alväger and Hans Ryde (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 17, 535-51(1960). (In English)

Some possibilities for the observation of double quantum emission from an excited nuclear level are considered. In particular the decay of the isomeric $h_{11/2}$ level in Xe^{131} was experimentally studied with emphasis on this second order effect. The measurements were performed by observation of the coincidence relations between x rays and gamma or x radiation. A number of processes which can possibly contribute to the results obtained are discussed in detail. The possibility that double quantum emission was observed remains then as the most probable one. With this assumption it is possible to estimate an experimental value for the ratio between the transition probabilities for double and single quantum emission in the decay of Xe^{131m} to about one part in a thousand. (auth)

22369

ISOMERIC TRANSITIONS IN Pb^{205}. Rune Stockendal (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 17, 553-78(1960). (In English)

From measurements with electromagnetically isotope-separated samples in a double-focusing β spectrometer, a 26.22 ± 0.01-kev transition in Pb^{205} was identified from its internal L_I, L_{II}, L_{III}, M_I, M_{II}, M_{III}, M_{IV}, N_I, N_{III}, and O_I conversion lines. The multipolarity was proved to be M2. There is strong evidence that this transition takes place from a 4.0 msec $i_{13/2}$ state of 1013.8 kev to the 987.6-kev state in Pb^{205}, thus causing the latter state to appear metastable, as was earlier reported. This suggestion is also supported by the identification of a 310.5-kev E3 transition which probably takes place between the isomeric state and the 703.3-kev state. Furthermore, there is reason to believe that the expected M4 transition to the ground state is seen as part of a radiation of 1014.0 kev observed in the decay of Bi^{205}. The separation between the $i_{13/2}$ and $f_{9/2}$ levels is found to fit well into the systematics of the odd lead isotopes. The electromagnetically separated sources were used also for a conclusive establishment of a 262.8-kev M1 transition in Pb^{205} (cf. the 262.8-kev M1 transition in Pb^{206}). The possibility that this transition is associated with the first excited state is discussed. Some further conversion lines were also studied in the double-focusing spectrometer. In addition, the relative intensities of the KLL Auger lines in lead were measured and found to be in fairly good agreement with theoretical relativistic calculations. (auth)

22370

INTERNAL AND EXTERNAL CONVERSION STUDIES ON THE DECAY OF Bi^{203} AND Bi^{204}. Rune Stockendal (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 17, 579-96 (1960). (In English)

The internal K-conversion coefficients of 7 transitions following the decay of Bi^{203} (including the 279.1-kev transition in Tl^{203}) and 5 transitions from the decay of Bi^{204} were determined absolutely by the method of comparing internal and external conversion lines measured in a double-focusing spectrometer. The multipolarity assignments based on these values are, in cases where a comparison is possible, in agreement with the assignments suggested from the measured internal conversion ratios or other data. Complementary measurements of energies and intensities of low-energy conversion lines in Pb^{203} were carried out in the double-focusing spectrometer. The level scheme of Pb^{203} is discussed. The half-lives of Bi^{203} and Bi^{204} were remeasured and found to be 11.76 ± 0.05 hr and 11.22 ± 0.10 hr, respectively. (auth)

22371

THE FISSION CROSS-SECTION OF Pu^{240} FOR NEUTRONS OF ENERGY FROM 0.04 to 4.0 Mev. V. G. Nesterov and G. N. Smirenkin. Atomnaya Energ. 9, 16-20(1960) July. (In Russian)

The cross section of Pu^{240} fission was studied in order to verify the theoretical concepts of fission energy dependence and the feasibility of utilization of Pu^{240} as nuclear fuel in fast reactors. The energy dependence of the effective cross sections for Pu^{240} fission by 0.04 to 4.0 Mev neutrons was measured. The reaction $T(p,n)He^3$ was used as a neutron source. At 1 to 4 Mev the Pu^{240} cross section is ~1.6 barn and is two-fold smaller at $E_n \simeq 0.7$ Mev. A rapid reduction of the fission cross section takes place as E_n falls to 0.3 Mev; following this it reduces slower and finally becomes constant (0.065 barn) at $0.04 < E_n < 0.15$ Mev. Correlations of irregularities in the fission cross sections with the levels of Pu^{240}, corresponding to the inelastic scattering channels, are discussed. (tr-auth)

22372

ON He^7. V. V. Balashov. Atomnaya Energ. 9, 48-9(1960) July. (In Russian)

Production of He^7 and experiments on the direct observation are described. The isotope is β active, and transitions to the ground and first excited (0.477 Mev) states of Li^7 are prevalent. The upper boundary of the β spectrum is ~10 Mev. The log $f\tau$ value calculated with the shell model in j-j coupling approximation is 3.26 and increases with j-j coupling deviation. The lifetime of He^7 is considered to be ~30 to 100 μsec. The decay can be observed directly in radiation transitions between the Li^7 first excitation and ground states. The isotope is produced by the following reactions: $Li^7(n,p)He^7$, $Q \simeq -10$ Mev; $Be^9(\gamma,2p)He^7$, $Q \simeq 29$ Mev; $Be^9(n,He^3)He^7$, $Q \simeq 21$ Mev; $Li(d,2p)He^7$, $Q \simeq -12$ Mev; $C^{12} + \pi^- \rightarrow He^7 + \alpha + p$; $B^{11} + \pi^- \rightarrow He^7 + \alpha$; $Li^7 + \pi^- \rightarrow He^7$. The positive He^7 energy is found by characteristic correlation with $He^6 + n$. (R.V.J.)

22373

THE EFFECTIVE ENERGY OF THE Ra GAMMA RAY (FILTERED BY 0.5 mm PLATINUM). Yasuyuki Moriuchi, Katsuhiro Kawashima, and Toru Yagi. Denki Shikensho Ihô 22, 769-84(1958).

The relative intensities (in the strict sense of the word, it must be relative exposure dose rate) of Ra^{226} and its daughter's γ rays, filtered by 0.5 mm platinum, are given as a function of the distance between the source and any point of interest. The calculations of these intensities are carried out under the conditions of narrow beam and free air field, and are on the basis of the newest values of mass energy absorption coefficients given by I.C.R.U. Report (1956) or Whytes etc. These calculated values are compared with the experimental results of Ra γ-ray measurements. There are some discussions on the definition of the effective energy of non-monochromatic γ rays, and the effective energy of Ra γ ray is given as about 1.3 Mev. (auth)

22374

ALPHA RADIATION OF U^{233}. B. S. Dzhelepov, R. B. Ivanov, V. G. Nedovesov, and Yu. T. Puzynovich (Khlopin Radium Inst., Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 258-60(1960) Mar. (In Russian)

A magnetic α spectrometer was used for investigating

the U^{233} spectrum from two sources. The half-width of the spectral line of the first source was 8 kev and of the second 10 kev. Measurements showed in addition to the known transition lines, daughter lines of Th^{229} with energies of 29, 72, 126, and 195 kev, which fit well into the rotational band with quantum number k = 5/2 initiated at 29 kev. The experimental ratio of the band energies is 1 : 2.26 : 3.87 and the theoretical is 1 : 2.28 : 3.86. An analysis of the excited level of Th^{229} indicates a quantum number of 5/2− for the 29 kev level and for the 72, 126, and 195 kev levels, 7/2−, 9/2−, and 11/2−, respectively. The decay scheme for U^{233} is presented. (R.V.J.)

22375

RADIOACTIVE DECAY OF Th^{231}. S. A. Baranov, R. M. Polevoĭ, Yu. F. Rodionov, G. V. Shishkin, and V. M. Shubko. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 261-71(1960) Mar. (In Russian)

The beta decay of Th^{231} was studied in order to plot the Pa^{231} energy levels. The scheme was analyzed from the point of view of Bohr nuclear models and Nilsen's theoretical schemes. The soft γ radiation spectra of Pa^{231} recorded by proportional counters filled with heavy gases (Kr + CH_4 and Xe + CH_4) were plotted, and lines from the decay $Th^{231} \rightarrow Pa^{231}$ are analyzed and tabulated. Multiple γ transitions and absolute and relative conversion coefficients for Pa^{231} γ rays are also tabulated, and a decay scheme for Th^{231} and energy levels for Pa^{231} are presented. (R.V.J.)

22376

CONVERSION ELECTRONS AND γ RAYS OF Tm^{165}. K. Ya. Gromov, B. S. Dzhelepov, A. G. Dmitriev, V. A. Morozov, and K. I. Yakovlev. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 272-7(1960) Mar. (In Russian)

The conversion electron spectrum of Tm^{165} was studied with a magnetic spectrometer with a relative half-width of 0.4% and resolving power of 0.4%. The γ rays were studied with a scintillation spectrometer. The half-width of the Cs^{137} γ at 661 kev was 12%. Measurements were made on a thulium fraction prepared by chromatographic separation of products from Ta spallation by 660-Mev protons. Chromatographic separation 15 to 20 hours after irradiation produced the following isotopes: Tm^{166}(7.7 hours), Tm^{165} (29 hours), and Tm^{167} (9.6 days). It was found that K capture transforms Tm^{165} with half-life of 29 hours into Er^{165}, which in turn decays by K capture with half life of 10 hours into stable Ho^{165}. The radiation spectra of Tm^{165} above 350 kev are investigated. (R.V.J.)

22377

ON THE 75 MIN ACTIVITY OF YTTERBIUM. A. A. Abdurazakov, K. Ya. Gromov, B. S. Dzhelepov, Yu. V. Norsev, G. Ya. Umarov, and V. G. Chumin (Joint Inst. for Nuclear Research, Dubna, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 278-82(1960) Mar. (In Russian)

The electron and positron spectra produced in the decay of 75-min ytterbium were studied with a magnetic β spectrometer with a homogeneous magnetic field. The half-width of the Cs^{137} K line was 0.8%. Filters were used in recording electrons with energies below 60 kev. The ytterbium was obtained from proton spallation of tantalum. The positron spectra in the 1300 to 2940 kev region showed no deviation from the characteristic shape of permissible β transitions. The maximum energy of the positron spectrum was 2940 ± 20 kev. At 1300 kev the outline of the spectrum deviates from the Fermi plot. Electron conversion spectra showed L and M lines for a 91.5 kev transition and K and L lines for a 211 kev transition. A decay scheme for Yb^{164} is plotted, and the 75 min half life is attributed to it. (R.V.J.)

22378

POSITRON SPECTRA OF NEUTRON-DEFICIENT ISOTOPES. N. A. Bonch-Osmolovskaya, B. S. Dzhelepov, and O. E. Kraft. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 283-7(1960) Mar. (In Russian)

Positron spectra of neutron-deficient isotopes of lutetium, thulium, erbium, and dysprosium, produced by 680-Mev proton bombardment of tantalum, were studied with a β spectrometer with triple focusing. The hard component of lutetium had the border energy of 2800 kev. All lines above 1500 kev corresponded to a half life of 85 ± 18 min. The complex lutetium spectrum indicated three border energies of 1530 ± 200, 1110 ± 100, and 600 ± 50 kev. It is postulated that the positrons with 2800 kev energy and half life T = 85 min are from a new Lu^{168} isotope, or an admixture of ytterbium which has a half life of 75 min. The scheme of a positron spectrum with half life 137 ± 15 min showed two components with 1050 ± 80 and 400 ± 50 kev energy and relative intensities of 1 : 0.7. The mass difference $Tm^{163} - Er^{163}$ is > 1050 + 1020 = 2070 kev. The positron spectrum of the erbium fraction indicated in addition to the 1300 kev emission with half life 2.5 hours, a low-intensity positron "tail" with an energy of 3 Mev. The Curie plot of the hard component indicated a complex spectrum of two components 1900 ± 100 and 2980 ± 100 kev and relative intensity 5 : 1. Measurements of the electron spectrum indicate a conversion line of ~900 kev and half life 2 hours. It is assumed that the above line and the β^+ emission at ~3000 kev belong to the same isotope, probably Ho^{158}. Measurements on the dysprosium fraction 3.5 hours after irradiation and an hour following the separation showed unique behavior in various parts of the β^+ spectrum. After separation the intensity increased for 9 to 10 hours, then dropped with a half life of 18 hours. The spectrum consisted of two components of 2700 ± 100 and 1650 ± 100 kev and relative intensities of 3 : 1. Two sources of the spectrum are suggested. The first suggests the existence of the chain Dy^{154} (3 hours) Tb^{154} (18 hours) Gd^{154}, and the other considers that the increased activity is related to $Dy^{152} \rightarrow Tb^{152}$, obtained in the reaction $Eu^{151}(\alpha,3n)$ and $Gd^{152}(p,n)$ where the half life of Tb^{152} is 18 hours. In addition to the half life of 18 hours, a half life of 10 hours was found in the β^+ spectrum with an energy of ~900 kev. This is assumed to belong to Dy^{155}. (R.V.J.)

22379

ON β^- DECAY OF La^{140}. B. S. Dzelepov, B. A. Emel'yanov, K. P. Kupriyanova, and Yu. N. Podkopaev (Leningrad State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 288-90 (1960) Mar. (In Russian)

The possible β transition from ground state La^{140} to ground state Ce^{140} was studied. Seven series of electron emissions from La^{140} at 1800 to 4000 kev were measured. The β^- and electron conversion spectra are plotted and γ transitions and conversion intensities are tabulated. Correlations of theoretical and experimental magnitudes for conversion coefficients show that the γ transition at 2530 kev is related to M1; the transition type for 2920 kev could not be determined. The 3140 kev line indicates the presence of an excited level of such energy. The Ce^{140} excitation levels of 2920 and 3140 kev were assumed as the difference between La^{140} and Ce^{140} mass. (R.V.J.)

22380

GAMMA RADIATION OF Ag^{110*} AT 0.2 TO 2.0 Mev. N. A. Voinova, B. S. Dzhelepov, and N. N. Zhukovskiĭ (Khlopin Radium Inst., Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 291-9(1960) Mar. (In Russian)

The gamma spectra of Ag^{110*} at 0.2 to 2.0 Mev were investigated. The spectrum of recoil electrons from Ag^{110*} γ rays is plotted. Fourteen γ lines with intensity >1% of the 656 kev line intensity were found at 440 to 1600 kev.

Analysis of the electron data for 300 to 400 and 450 to 600 kev regions confirmed the absence of lines with intensity >1% and >0.8% of the 656 kev intensity. No 723 kev γ lines or γ lines with intensities >3% of the 656 kev in the 930 to 1350 kev region were found. Multiplicities of 12 γ transitions were determined. The multiplicity of E2 transition $h\nu$ = 656 kev is known from direct measurements and from the cross section of Coulomb excitation at 656 kev in Cd^{110} with lifetime $\tau = (5.7 \pm 0.8) \times 10^{-12}$ sec. Correlations of the experimental magnitude of α_k with theoretical show that multiplicity E2 can be applied only to two γ transitions with $h\nu$ = 885 and 936 kev. The mixture of E1 and M2 (suggested previously) is not probable as it is observed in strong E1 forbiddeness in strongly deformed nuclei. Moreover, E1 + M2 for 885 and 936 kev transitions contradict the parity of 1541 and 2476 kev levels in Ag^{110*} decay. The multiplicities of the remaining 10 γ transitions were not determined exactly; however, they were found to be less than quadrupole. The decay schemes of Ag^{110*} and Ag^{110} are included. (R.V.J.)

22381

GAMMA SPECTRA OF Eu^{152} AND Eu^{154} AT 245 TO 500 AND 1450 TO 2000 KEV. B. S. Dzhelepov and Yu. V. Khol'nov (Khlopin Radium Inst., Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 300-3 (1960) Mar. (In Russian)

The gamma spectra of Eu^{152} and Eu^{154} at 245 to 500 and 1450 to 2000 kev were studied with a magnetic γ spectrometer. The ratio of Eu^{154} and Eu^{152} was determined on the basis of the γ quanta 1280(Eu^{154}) and 1411 (Eu^{152})kev to be 0.21 ± 0.03. Energies and relative intensities for Eu^{152} and Eu^{154} are tabulated. Electron recoil spectra and decay schemes are plotted. (R.V.J.)

22382

RESONANCE SCATTERING OF La^{140} γ RAYS. B. S. Dzhelepov and M. A. Dolgoborodova. Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 304-10(1960) Mar. (In Russian)

Resonance scattering of La^{140} and Ce^{140} γ rays was studied using a La^{140} source (~50 mc) in the form of La $(NO_3)_3$ in nitric acid. The scheme of the experimental device is shown. The half width of the total absorption peak for 1597 kev was 13%. Eleven series of resonance scattering measurements are plotted and analyzed. (R.V.J.)

22383

GAMMA SPECTRUM OF W^{187}. B. S. Dzhelepov, V. L. Rumyantsev, Yu. V. Khol'nov, and G. E. Shchukin (Khlopin Radium Inst., Academy of Sciences, USSR). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 311-12(1960) Mar. (In Russian)

The gamma radiations of W^{187} were measured with a magnetic γ spectrometer. The total spectrum is plotted with corrections for absorption. The data show considerably higher magnitudes than those shown in published data; the difference in the intensity of the 864 kev line is 10 fold and between 691 and 558 kev it is also considerable. Gamma rays with intensities <0.3% of the 488 kev intensity were not observed in the 950 to 1350 kev region. (R.V.J.)

22384

CORRELATIONS OF THE THEORY OF NON-AXIAL NUCLEI WITH EXPERIMENTS. E. P. Grigor'ev and M. P. Avotina (Leningrad State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 324-35(1960) Mar. (In Russian)

The theory of non-axial nuclei permits an accurate determination of rotation levels for nuclear ground states and for other non-rotational levels. The theory is in good agreement with experiments on deformed nuclei. By simple calculations the ratio of probabilities for E2 or E1 transitions from an arbitrary level to levels of one rotational band can be determined. However, in some cases the theory does not agree with experiment. Certain deviations from the theoretical predictions are observed in the spectra of Sm^{152}, Gd^{154}, Os^{186}, Os^{188}, and Os^{190} though there is no doubt that they are rotational. Previously an analysis was made of even-even nuclear rotational levels under the assumption that the nuclei had equilibrium shape but are not axially symmetric. With the angle $\gamma = 0°$ and 6° the nuclei are axially symmetric; at $\gamma = 30°$ there is a considerable deviation to ellipsoidal rotation. The relative magnitudes of ellipsoidal axis as a function of γ with a deformation parameter $\beta = 0.3$ are given. An attempt was previously made to show that the potential energy of a nucleus deflected from axial symmetry is at its minimum when the saturated shell has several extra nucleons. The postulation is supported with various assumptions. Energies are plotted as functions of γ, according to the non-axial nuclear theory, and correlated with experimental data for Sm^{152}, Gd^{154}, Gd^{156}, Dy^{160}, Er^{166}, Er^{168}, W^{182}, W^{184}, Os^{186}, Os^{188}, Os^{190}, Os^{192}, Pt^{192}, Hg^{198}, and Mg^{24}. The deformation parameter γ was determined in relation to levels with 2^+ characteristics. The theory and experiment are in good agreement only for Gd^{156} and Pt^{192}. Tabulated corrections introduced for the other nuclei show that the corrections to the levels are related not only to adiabatic disturbances but also to other factors. The probabilities of transitions and the applicability regions of the theory are analyzed. (R.V.J.)

22385

ROTATIONAL LEVELS OF DEFORMED ODD-ODD NUCLEI. L. K. Peker (Leningrad State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 365-8(1960) Mar. (In Russian)

The rotational schemes of Eu^{152}, Eu^{154}, Lu^{174}, Lu^{176}, Ta^{182}, and Re^{188} are developed, and the energy of the rotational levels is evaluated. (R.V.J.)

22386

INTERPRETATION OF HIGH EXCITATION LEVELS OF W^{182}. L. K. Peker (Leningrad State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 369-71(1960) Mar. (In Russian)

The high excitation levels of odd-odd deformed W^{182} are interpreted within the framework of the generalized nuclear model. The scheme of W^{182} rotational levels is plotted, and the band of each level is found. (R.V.J.)

22387

MAGNETIC MOMENTS OF DEFORMED NUCLEI WITH $K = 1/2$. L. K. Peker and D. A. Varshalovich (Leningrad State Univ.). Izvest. Akad. Nauk. S.S.S.R., Ser. Fiz. 24, 372-6(1960) Mar. (In Russian)

It is shown that experimental magnitudes μ_0 for Yb^{171} and W^{183} demand renormalization of the gyromagnetic ratio for g_s and g_e (the spin and orbital gyromagnetic ratio of non-paired protons or neutrons). Additional experimental data on rotational levels and magnetic moments of Tm^{169}, Yb^{171}, and Pu^{239} are included. (R.V.J.)

22388

THE LIGHT TERBIUM ISOTOPES. A SURVEY OF HALF-LIVES AND γ-RAY SPECTRA WITH THE USE OF MASS-SEPARATED SAMPLES. K. S. Toth, S. Bjørnholm, M. H. Jørgensen, O. B. Nielsen, O. Skilbreid, and Å. Svanheden (Univ. of Copenhagen). J. Inorg. & Nuclear Chem. 14, 1-7 (1960) July. (In English)

Gadolinium oxide was bombarded with 65 Mev protons to produce terbium nuclides. Following a chemical separation

the terbium fraction was mass separated. The different mass samples were studied for their half lives. Gamma-ray spectra were taken in most cases. New information was found concerning γ rays of the extremely light isotopes, i.e., Tb^{149} through Tb^{152}. Tb^{150} was discovered for the first time. The results obtained on the remaining isotopes are in agreement with earlier data in the most recent Table of Isotopes (April 1958). (auth)

22389

THE MASS-YIELD CURVE FOR FISSION OF ^{237}Np BY 14.5 Mev NEUTRONS. R. F. Coleman, B. E. Hawker, and J. L. Perkin (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). J. Inorg. & Nuclear Chem. 14, 8-13 (1960) July. (In English)

The mass-yield curve for the fission of Np^{237} by 14.5 Mev neutrons was determined. An absolute yield of 4.94% for Mo^{99} was measured and used to normalize the mass-yield curve. The shape of the curve is very similar to the U^{235} and U^{238} fission-yield curves with neutrons of the same energy. The chief difference is the smaller peak-to-trough ratio which for Np^{237} is approximately 4.4. Brief details of the separation schemes and counting methods are given. (auth)

22390

NUCLEAR ABSORPTION OF PHOTONS BY C^{12} AND Al^{27}. G. Tamas, J. Miller, C. G. Schuhl, and C. Tzara (Centre d'Études de l'Énergie Nucléaire, Saclay, France). J. phys. radium 21, 532-6(1960) June. (In French)

A Compton spectrometer was used for measuring by transmission the total absorption nuclear cross-section of C^{12} and Al^{27}. The results are compared with the predictions of various sum rules. Some interesting facts appear, but it is necessary to increase the precision of the measurements. (auth)

22391

ON THE SHAPE OF EVEN-EVEN ATOMIC NUCLEI. Ling Wang (Moscow State Univ.). Nauch. Doklady Vysshei Shkoly, Fiz.-Mat. Nauki No. 1, 146-9(1960). (In Russian)

The theory of A. S. Davydov and G. F. Filipov is explored further, solving the problem for J = 6 and 8. The energy is found to be a minimum for γ not equal to either 0 or 60°, being the angular coordinate characterizing the nuclear shape eccentricity, thus indicating that nuclei in their ground states are axially non-symmetrical. The equilibrium value of γ is found to be independent of J and an almost straight line function of log l; l being defined by the equation $l = T\beta(\hbar^2/4\beta\beta^2)^{-1}$, where T is a parameter expressing the interaction between a pair of nucleons and the nuclear surface, β is the total deformation parameter, and the quantity in brackets is one-fourth the first excited state energy (ϵ_1). A plot of γ versus log l is presented together with a table of ϵ_1, equilibrium values of γ, $T\beta$, and β for a number of even-even nuclei. (TTT)

22392

LOW LYING LEVELS OF Li^7 AND Be^8 IN THE CLUSTER MODEL. L. D. Pearlstein, Y. C. Tang, and K. Wildermuth (Florida State Univ., Tallahassee). Nuclear Phys. 18, 23-39(1960) Aug. (1). (In English)

A study of the first few levels of Li^7 and Be^8 was conducted. To calculate the appropriate energies, a variational procedure was adopted in which some of the long-range nuclear correlations were incorporated in the wave function wherein they appear as favored cluster configurations, i.e., alpha, triton groups. Agreement with experiment was obtained for the three rotational levels of Be^8 and the two rotational levels of Li^7. For the first change of parity level in the latter nucleus, however, arguments are presented indicating that the inclusion of a deuteron substructure would reproduce the properties of this level. (auth)

22393

GYROMAGNETIC FACTORS OF DEFORMED ODD-MASS NUCLEI WITH $153 \leqq A \leqq 187$. E. M. Bernstein and J. De Boer (Univ. of Copenhagen). Nuclear Phys. 18, 40-5 (1960) Aug. (1). (In English)

Recently available experimental data are combined to obtain accurate values of the reduced magnetic dipole transition probabilities between rotational states of deformed odd-mass nuclei. These results are interpreted on the basis of the rotational model to yield the gyromagnetic factors g_R and g_K. It appears that the values of g_R vary rather smoothly with the atomic number and have a minimum at $A \approx 170$, and that g_R is smaller for odd neutron nuclei than for odd proton nuclei. (auth)

22394

QUASI-ELASTIC SCATTERING OF 153 MEV PROTONS BY p-STATE PROTONS IN C^{12}. I. EXPERIMENTAL. T. J. Gooding and H. G. Pugh (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 18, 46-64 (1960) Aug. (1). (In English)

For the reaction $C^{12}(p, 2p)B^{11}$ at 153 Mev, the energies of the two protons emitted in each event are measured with plastic scintillators, and added. The summed-energy spectrum shows a well-defined peak corresponding to an energy loss of 16 Mev in the reaction, and events in this peak are interpreted as those in which a proton is knocked out of the p-shell in carbon. For coplanar p-state events, angular correlations and energy spectra are measured with one counter fixed at 15, 20, 30, 40, 60, and 80° relative to the incident beam and the angle of the other varied between 15 and 80° on the other side of the beam. The angular correlations are sharply peaked, while for the peak the separation angle between the two outgoing protons depends markedly on the angle at which one proton is detected, varying from 35° when the fixed counter is set at 15 to 110 when it is at 80°. The results are consistent with the mechanism of quasi-elastic p–p scattering when the momentum distribution of the struck protons is taken into account. A rough value is obtained for the total cross-section for p-state events. It is about one-sixth of the expected value in the absence of absorption, thus showing the importance of this process. By comparison of the experimental results with distorted-wave calculations it should be possible to determine the momentum distribution of the p-state protons and the magnitude of the distortion effects themselves. (auth)

22395

THE ELECTRIC QUADRUPOLE INTERACTION IN BETA DECAY. J. M. Pearson and M. A. Preston (McMaster Univ., Hamilton, Ont.). Nuclear Phys. 18, 91-109(1960) Aug. (1). (In English)

In the β-decay of strongly deformed nuclei the electrostatic field in which the decay electron moves by no means possesses the spherical symmetry that it has been customary to assume in β-decay theory. The angular momentum of the electron will not be conserved and different, closely lying, rotational states of the daughter nucleus will be coupled together. The possibility is considered that it is this electric quadrupole coupling, rather than a failure of pure rotational structure, that is responsible for the observed anomalies in the branching ratios of the first forbidden decays of Lu^{176}, Ta^{180}, and Np^{236}. The general theory of the β-decay of strongly deformed nuclei is set up, taking into account the electric quadrupole coupling, and specialized to the case of first forbidden decays of even nuclei. The electron functions are obtained by an essentially exact method,

the Dirac equation appropriate to a non-central interaction being solved numerically on a computer. It is found that the coupling effect on the branching ratio can be no larger than 4% or so, which is far too small to account for the observed values. (auth)

22396

SYMMETRY PROPERTIES OF THE DISTORTED WAVE THEORY OF DIRECT NUCLEAR REACTIONS. G. R. Satchler (Oak Ridge National Lab., Tenn.). Nuclear Phys. 18, 110-21(1960) Aug. (1). (In English)

It is shown that under certain simple conditions, often nearly realized experimentally, the transition amplitudes in the distorted wave Born approximation theory of direct nuclear reactions have a simple symmetry under interchange of the distorted waves for initial and final states. For observations on the reaction, the symmetry is equivalent to rotating coordinate axes by π about the recoil direction. This property is used to show in detail how the initial and final distortions have opposing effects for some phenomena (such as polarization of emitted particles or change of symmetry axis for the distribution of subsequent γ-rays) but are cooperative for others (such as the differential cross-section). Some conclusions are drawn about distortion effects in various types of reaction. (auth)

22397

INVESTIGATION OF POLARIZATION OF INTERNAL CONVERSION ELECTRONS EMITTED AFTER β^--DECAY IN HEAVY ELEMENTS. M. E. Vishnevskii (Vishnevsky), V. A. Lyubimov, E. F. Tret'yakov, and G. I. Grishuk (Inst. of Theoretical and Experimental Physics, Academy of Sciences, Moscow). Nuclear Phys. 18, 122-30(1960) Aug. (1). (In English)

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 19759.

22398

INVESTIGATION OF INTERNAL BREMSSTRAHLUNG CROSS-SECTION WITH SPECIFIED ELECTRON AND PHOTON ENERGIES. J. E. Thun, B. G. Pettersson, and K. Siegbahn (Inst. of Physics, Upsala). Nuclear Phys. 18, 131-7(1960) Aug. (1). (In English)

The internal bremsstrahlung from P^{32} was measured by a coincidence arrangement, where the electrons were detected in a lens spectrometer and the photons in a NaI(Tl) scintillation crystal. By selecting a certain energy in the β-spectrometer it was possible to test the differential probability for the internal bremsstrahlung emission as given by the theory of Knipp and Uhlenbeck. The angle between the electron and photon was chosen to be 90°. The result shows good agreement for all electron energies chosen. (auth)

22399

ON THE PSEUDOSCALAR INTERACTION IN $0^- \rightarrow 0^+$ BETA TRANSITIONS. Dubravko Tadić (Institute "Rudjer Bošković," Zagreb). Nuclear Phys. 18, 138-48(1960) Aug. (1). (In English)

The correction factors for the spectrum and longitudinal polarization of electrons in $0^- \rightarrow 0^+$ transitions for the axial vector and pseudoscalar interaction are calculated in the non-relativistic approximation up to the order $(v/c)^2$. Various possible non-relativistic approximations are discussed. Numerical analysis was undertaken for $Pr^{144} \rightarrow Nd^{144}$ transitions. Different results obtained in earlier analyses are explained. From measurements of longitudinal polarization of electrons it seems that $0^- \rightarrow 0^+$ transitions are difficult to explain by pure axial vector interaction. (auth)

22400

A MEASUREMENT OF THE NEUTRON ABSORPTION CROSS SECTION OF ALUMINUM. M. Brose and K. H. Beckurts (Inst. für Neutronenphysik und Reaktortechnik, Karlsruhe, Ger.). Nukleonik 2, 139-41(1960) June. (In German)

A measurement of the absorption cross section of aluminum for slow neutrons is reported. The measurement is made by a comparison of the integrated neutron flux in the vicinity of a neutron source in an aluminum and in a paraffin arrangement. A value $\sigma_a = 220 \pm 13$ mb is obtained for $v = 2200$ m/sec. (tr-auth)

22401

RESULTS OF THE PHYSICS OF NUCLEAR FISSION. [PART] II. A. Kraut (Technische Hochschule, Munich). Nukleonik 2, 149-74(1960) June. (In German)

The review of the experimental results obtained in the study of nuclear fission is concluded. In this section the kinetic energy of fission products, anisotropy of fragment emission, nuclear charge of the fission products, and prompt neutrons and gamma radiation are discussed. (J.S.R.)

22402

PHOTONEUTRON REACTIONS: C^{12}, N^{14}, O^{16}, AND F^{19} NEAR THRESHOLD. K. N. Geller, J. Halpern, and E. G. Muirhead (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 119, 716-20(1960) July 15.

Photoneutron reactions in carbon, nitrogen, oxygen, and fluorine were studied in the region of threshold using improved efficiency for the detection of the residual activity. The betatron energy calibration used is based on thresholds of deuterium, bismuth, copper, and for scattering from the 15.12-Mev level in carbon. Results show that the thresholds for nitrogen and fluorine correspond well with the expected values for the respective neutron separation energies. For oxygen, the position of threshold is also in good agreement. Assuming a linear extrapolation of the betatron calibration above 15 Mev, it is found that the carbon threshold is 52 kev above the accepted value of the separation energy. The successful correlation between the assignment of known resonance energies with the positions of many of the breaks in the yield curves corroborates the assumed linearity of the betatron energy scale above 15 Mev. It follows that previous betatron calibrations using the carbon threshold must be in error by approximately 100 kev at 18.7 Mev. (auth)

22403

ODD-EVEN DEPENDENCE OF NUCLEAR LEVEL DENSITY PARAMETERS. R. E. Bullock and R. G. Moore, Jr. (Convair, Fort Worth, Tex.). Phys. Rev. 119, 721-31(1960) July 15.

Previously reported experimental (n,p) and (n,α) cross section data were analyzed to determine nuclear level density parameters for the Fermi gas model which best fit the experimental data for target nuclei ranging in mass number from 9 to 64. Level density parameters for odd-odd and even-even nuclei are obtained in terms of those for the better known odd-A values. The results of this analysis are $\frac{1}{2}C_{\text{odd-odd}} = C_{\text{odd A}} = 5C_{\text{even-even}}$. Brief mention is made of the direct-interaction contribution in (n,p) reactions. Experimental measurements which would be most beneficial for further theoretical analysis are suggested. (auth)

22404

EXCITED STATES OF P^{32}. D. Piraino, C. H. Paris, and W. W. Buechner (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 119, 732-5(1960) July 15.

The proton groups from the $P^{31}(d,p)P^{32}$ reaction were

studied at angles of 30, 50, 70, and 90 degrees. The incident deuteron energy was 6 Mev, and the protons were analyzed with a broad-range magnetic spectrograph. Fifty-two excited states were found in the region between the ground state and 6.2 Mev in P^{32}. (auth)

22405

RESULTS OF STRIPPING ANALYSIS OF THE $Co^{59}(d,p)Co^{60}$ REACTION. H. A. Enge, D. L. Jarrell, and C. C. Angleman (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 119, 735-40(1960) July 15.

The MIT-ONR electrostatic generator and broad-range magnetic spectrograph were used to investigate proton groups produced by bombarding thin cobalt targets with 6.0-Mev deuterons. The angular distributions of the twenty-eight most intense proton groups corresponding to as many levels in Co^{60} were analyzed in terms of stripping theory to determine the orbital angular momentum of the captured neutron. The Q values of the (d,p) reaction were measured for sixty levels of Co^{60}. The ground-state Q value was found to be 5.262 ± 0.011 Mev. (auth)

22406

TENSOR FORCE EFFECTS IN ODD-ODD SPHERICAL NUCLEI. Neal D. Newby, Jr. (Univ. of California, Berkeley). Phys. Rev. 119, 747-8(1960) July 15.

A study of the ground-state coupling rules in odd-odd spherical nuclei reveals that in almost all cases where Nordheim's weak rule is applicable both particles have spin and orbital angular momentum parallel rather than antiparallel. A semiclassical model is employed to indicate that an attractive n-p tensor force will tend to break down Nordheim's weak rule. Examination of the quantum-mechanical formula substantiates this finding. (auth)

22407

PHOTOPROTON AND PHOTONEUTRON PRODUCTION IN ALUMINUM AND COPPER. R. E. Chrien and A. H. Benade (Case Inst. of Tech., Cleveland). Phys. Rev. 119, 748-54 (1960) July 15.

The ratio of proton to neutron yields from aluminum and copper irradiated with betatron x rays up to 20.8 Mev in energy was measured. Simultaneous detection of protons and neutrons is accomplished by placing two samples of the same element in series in the x-ray beam. Direct detection methods are used in each case, a shallow proportional counter for protons and a boron-lined detector for neutrons. A photon difference method was used to reduce yield data to cross section form. The proton and neutron yields for aluminum are found to be approximately equal at 20 Mev with cross sections of 19 and 21 millibarns, respectively. At 20.8 Mev a yield ratio of one proton to about 6 neutrons is found for copper, with a peak photoproton cross section of 23 millibarns. The results are compared to a calculation based on the assumption that these reactions proceed through the formation of a compound nucleus. (auth)

22408

DECAY OF 6.3-MIN Br^{78}. William R. Pierson and Charles D. Coryell (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 119, 755-60(1960) July 15.

The nuclide 6.3-min Br^{78} was made by the reactions (γ,n), $(n,2n)$, (p,n), $(d,2n)$, and (α,n), and its decay properties were investigated by positron decay-curve analysis, by application of a standard chemical isomer-separation produre, by searching for conversion electrons, and by studying the gamma-ray and positron-gamma-coincidence spectra. The early portion of the positron decay curve exhibited a single 6.25 ± 0.2-min component, and no active daughter of this species was chemically separable from active CBr_4. Conversion electrons were not found, and soft gamma rays were shown to be absent. There are 12-kev x rays, of intensity about 0.05 relative to the positrons and therefore presumed to be K x rays of Se resulting from electron capture. These results show that 6.3-min Br^{78} has no daughter isomer and probably no >10-sec parent isomer. There is a 615-kev gamma ray, in coincidence with positrons, and of intensity 0.139 that of all positrons, representing decay of Br^{78} to Se^{78} in the 615-kev 2+ state. However, no evidence for decay to Se^{78} in the 1.32-Mev state could be found. From these data it was deduced that 6.3-min Br^{78} decays 81% by positron emission and 6% by electron capture to ground-state Se^{78}, 11% by positron emission and 2% by electron capture to Se^{78} in the 615-kev state, and <1% to Se^{78} in the 1.32-Mev state. The disintegrations of Br^{78} to Se^{78} in the ground state and 615-kev state have log ft values of 4.8 and 5.2, respectively, indicating that the spin of ground-state Br^{78} is 1, with even parity. The absence of isomerism is discussed in terms of the locations of expected energy levels with reference to the known locations of these levels in Br^{80}. (auth)

22409

POLARIZATION OF PROTONS SCATTERED FROM C^{12}. T. A. Tombrello, R. Barloutaud, and G. C. Phillips (Rice Inst., Houston, Tex.). Phys. Rev. 119, 761-6(1960) July 15.

The polarization of protons elastically scattered from carbon in the energy region between 4.65 and 5.0 Mev was measured by double scattering from carbon targets. These results, together with the findings at Harwell by Evans and Grace, show that the polarizations predicted from the phase shift analysis are somewhat in error. This disagreement may be explained by making small changes in the splitting of the P- and D-wave phase shifts without seriously affecting the fit to the angular distributions. It was found that in the energy range from 3.0 to 4.0 Mev the D-wave phases required from 1 to 4° additional splitting, while in the range from 4.0 to 5.0 Mev the splitting of the P-wave phases had to be reduced by 4°. These modified phase shifts give a revised contour map of spin polarization versus energy and angle. (auth)

22410

ENERGY LEVELS OF THE SILICON ISOTOPES FROM INELASTIC PROTON SCATTERING. R. E. White (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 119, 767-71 (1960) July 15.

Energy levels of the stable isotopes of silicon, Si^{28}, Si^{29}, and Si^{30}, up to 6.5-Mev excitation were investigated by studying the inelastic scattering of 7.5 to 8.5-Mev protons from a thin silicon-dioxide target with a broad-range magnetic spectrograph. Several new levels are reported, and the significance of the Si^{28} results is discussed in regard to a previously proposed interpretation of the level spectrum. (auth)

22411

EVIDENCE FOR SMALL DEVIATIONS IN THE ALLOWED POSITRON SPECTRUM OF Zr^{89}. J. H. Hamilton (Indiana Univ., Bloomington and Vanderbilt Univ., Nashville), L. M. Langer, and W. G. Smith. Phys. Rev. 119, 772-6(1960) July 15.

The decay of Zr^{89} was carefully studied with magnetic and scintillation spectrometers with special emphasis on the detailed shape of the positron spectrum. The decay scheme was verified. The positron decay is by a single allowed group followed by a single 915-kev gamma ray. The Zr^{89} spectrum has a non-statistical shape corresponding to an excess of low-energy beta particles. Theoretical refinements for screening and finite deBroglie wavelength

were applied but were found to be much too small to explain the observed deviation from a statistical spectrum. The same shape factor that was found to fit the In^{114}, Y^{90}, P^{32}, and Na^{22} data (in addition to the once forbidden, unique shape factor for Y^{90}) also fits the Zr^{89} data, i.e., $(1 + b/W)$ with $0.2 \leq b \leq 0.4$. It is significant that the deviation has the same direction and approximate magnitude as was found for the electron spectra. (auth)

22412

(d,p) AND (d,t) REACTIONS ON MAGNESIUM ISOTOPES. E. W. Hamburger and A. G. Blair (Univ. of Pittsburgh). Phys. Rev. 119, 777-87(1960) July 15.

Natural and enriched magnesium targets were bombarded with 14.8-Mev deuterons from the University of Pittsburgh cyclotron. The reaction products were magnetically analyzed and detected in a scintillation counter. Angular distributions from 10 to 60° (in some cases to 90°) were obtained for most of the following reactions: Mg^{24}(d,p) to the 0-, 1.61-, and 1.96-Mev levels of Mg^{25}, Mg^{25}(d,t) to the 0-, 1.37-, 4.12-, 4.24-, 5.24-, 6.01-, 7.33-, and 7.60-Mev levels of Mg^{24}, and Mg^{26}(d,t) to the 0-, 0.58-, 0.98-, 1.61-, 1.96-, 2.56-, 2.74-, 2.80-, 3.40-, and 3.90-Mev levels of Mg^{25}. The level at 7.60 Mev in Mg^{24} has not been reported before. The observed angular distributions are compared to stripping theory, and l values and absolute reduced widths are extracted. An anomaly in the angular distribution was found for the transitions between the Mg^{24} and Mg^{25} ground states and was studied as a function of incident deuteron energy. The reduced widths obtained are compared to the predictions of the rotational model, and, in general, good agreement is found; however, an admixture (of ≈15%) of higher rotational bands was found in the Mg^{26} ground-state wave function. (auth)

22413

DECAY OF $_{66}Dy^{166}$. R. G. Helmer and S. B. Burson (Argonne National Lab., Ill.). Phys. Rev. 119, 788-95(1960) July 15.

Samples of Dy^{166} were produced by successive neutron capture in stable Dy^{164}. This isotope decays by beta-ray emission with an 80.2-hr half-life to states in Ho^{166}. This isotopic assignment of previous authors is confirmed. Separations of the parent and daughter activities were carried out by use of an ion-exchange column. Scintillation studies were made with a 256-channel scintillation coincidence spectrometer. Internal-conversion electrons were measured in magnetic spectrographs with permanent magnets and the continuous beta spectra were observed with a 180° magnetic spectrometer with a variable field. The seven gamma-ray transitions observed had energies of 28.1, 54.2, 82.5, 288, 344, 375, and 428 kev. Beta-ray branches of 481 and 402 kev were observed with the magnetic spectrometer; two others of 114 and 56 kev are postulated for the decay scheme. The decay scheme presented indicates the existence of five levels in Ho^{166} at $0(0^-)$, $54(2^-)$, $82(1^-)$, 370, and $428(1^+)$ kev. The ground state and first two excited states are interpreted as members of a rotational band with K = 0. This interpretation implies that in odd-odd nuclei the level sequence can be inverted for the first two excited states of such a band. (auth)

22414

STATES OF EVEN-EVEN NUCLEI IN THE NEAR-HARMONIC REGION: SPECTRA OF Rn^{218}, Rn^{220}, AND Rn^{222}. F. S. Stephens, F. Asaro, and I. Perlman (Univ. of California, Berkeley). Phys. Rev. 119, 796-805(1960) July 15.

Gamma-ray singles and coincidence spectra were measured in the alpha decay of Ra^{222}, Ra^{224}, and Ra^{226}. Excluding the prominent transitions from the first excited states, the energies (and abundances relative to total α emission) of the observed radiations were: Ra^{222}: 325 kev (8.4×10^{-5}), 475 kev (7×10^{-5}), 525 kev (2×10^{-5}), and 798 kev (2.5×10^{-4}); Ra^{224}: 290 kev (9×10^{-5}), 410 kev (4×10^{-5}), 650 kev (6×10^{-5}); Ra^{226}: 260 kev (0.9×10^{-4}), 420 kev (7×10^{-6}), 450 kev (3×10^{-6}), 610 kev (1.0×10^{-5}). The observed gamma-gamma coincidences were Ra^{222}: 325–325 kev, 325–475 kev, and 325–525 kev; Ra^{224}: 241–290 kev and 241–410 kev; Ra^{226}: 188–260 kev and 188–420 kev. It was not strictly determined that the Ra^{222} radiations were not due to other members of the Th^{226} family. These data were used to deduce the following levels, spins, and parities in the daughter Rn nuclides: Rn^{218}: 650 kev, 2+; 800 kev, 1−; and, possibly, 850 kev, 4+. Rn^{220}: 530 kev, 2+; and 650 kev, 1−. Rn^{222}: 448 kev, 2+; and 610 kev, 1−. The 2+ states in Rn^{220} and Rn^{222} have been previously assigned by Scharff-Goldhaber. These results are incorporated in a general energy level systematics of even-even nuclei in the heavy element region. (auth)

22415

NUCLEAR MAGNETIC RESONANCE IN COPPER ALLOYS. ELECTRON DISTRIBUTION AROUND SOLUTE ATOMS. T. J. Rowland (Union Carbide Metals Co., Niagara Falls, N. Y.). Phys. Rev. 119, 900-12(1960) Aug. 1.

The effects of the addition to Cu of a wide variety of B subgroup elements on the nuclear magnetic resonance absorption of Cu are described. The resonance amplitude, which undergoes a sharp reduction upon alloying, is of special interest; its dependence upon solute valence and size argues decisively in favor of conduction electron charge redistribution (valence effects) as the dominant source of the electric field gradients surrounding these solutes. Furthermore, these gradients are shown to decrease only about as $1/r^3$ rather than exponentially as formerly supposed. Using the proportional change in the lattice parameter of the solid solution as a measure of the local strains surrounding a solute atom, only slight correlations between local strains and resonance amplitude were found. It is concluded that the origin of electric gradients around multivalent solutes in Cu is almost purely an effect of conduction electron distribution and that this distribution is not of the exponentially screened Coulomb charge type. The spatially oscillating charge distribution derived and recognized by Friedel and recently elaborated by Kohn and Vosko and Friedel and co-workers satisfactorily explains the observations. (auth)

22416

THEORY OF NUCLEAR RESONANCE INTENSITY IN DILUTE ALLOYS. W. Kohn and S. H. Vosko (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 119, 912-18 (1960) Aug. 1.

Experiments of Bloembergen and Rowland showed that the intensity of the nuclear resonance signal in metallic Cu decreases rapidly when small quantities of other elements are alloyed with it. These results require that each solute atom produce significant electric field gradients in its vicinity, sometimes affecting as many as 85 neighboring Cu nuclei. It is shown that field gradients of approximately the required magnitude arise from the redistribution of the conduction electron charge density near the solute atoms. A crucial feature of the theory is that at large distances r from a solute atom the electron density behaves as $\cos(2k^0r + \varphi)/r^3$ where k^0 is the Fermi wave number and φ is a phase. Agreement with experiment is a confirmation of this behavior. Such an oscillatory behavior is a consequence of a discontinuous drop

at the Fermi surface of n(k), the occupation probability of the conduction band function with wave vector k. (auth)

22417

THEORY OF SOLID He^3. N. Bernardes (Ames Lab., Iowa) and H. Primakoff. Phys. Rev. 119, 968-80(1960) Aug. 1.

A theoretical analysis is given of the properties of solid He^3 on the basis of: (1) a gas-phase Lennard-Jones "12-6" potential modified at small interatomic distances; (2) a Heitler-London type variational-trial wave function for all the atoms in the solid constructed from a properly antisymmetrized product of individual atom orbitals localized on the various lattice points; (3) a Dirac vector model to describe the symmetry energy with an exchange integral deduced from (1) and (2); (4) a spin-wave approximation at "low" temperatures and a Kramers-Opechowski approximation at "high" temperatures for calculation of the free energy of the nuclear spins; and (5) a Debye phonon model for the description of the vibrationally excited states of the solid. On this basis, calculated values at low pressures and temperatures ($p \approx 30$ atm; $T \lesssim 1°K$) are presented for: (a) the cohesive energy per atom; (b) the rms deviation of an atom from its lattice site: $\cong 0.36 \times$ nearest neighbor distance; (c) the nuclear magnetic susceptibility which corresponds to an antiferromagnetic behavior with a "paramagnetic" Curie temperature $T_c \cong 0.1°K$; (d) the variation (decrease) of T_c with increasing pressure corresponding to a possible nuclear antiferromagnetic to nuclear ferromagnetic transition for $p \approx 150$ atm; (e) the specific heat which exhibits an anomaly at $T \approx 0.1°K$ associated with the alignment of the nuclear spins; (f) the thermal expansion coefficient which becomes negative below about 0.6°K; (g) the melting curve which is characterized by a minimum at $T \cong 0.37°K$ and a maximum at $T \cong 0.08°K$. Comparison of the theory is made with available experimental data. (auth)

22418

NONLOCAL OPTICAL MODEL FOR NUCLEON-NUCLEAR INTERACTIONS. P. J. Wyatt (Ford Motor Co., Newport Beach, Calif.), J. G. Wills, and A. E. S. Green. Phys. Rev. 119, 1031-42(1960) Aug. 1.

An attempt is made to achieve a unified potential description of the gross structure of the nucleon-nuclear interactions in bound states and in states of scattering. A model is employed with a nonlocal complex diffuse potential with spin-orbit coupling and surface absorption. This represents a relatively simple nonlocal generalization of the usual static models which might reasonably be expected to describe the nucleon-nuclear interaction in the low-energy range (say from −25 to 25 Mev). Choosing the range of the nonlocal forces as suggested by considerations of the properties of infinite nuclear matter, the real parameters are fixed largely on the basis of neutron and proton separation energies. Two absorption parameters are then adjusted to provide agreement with total reaction and differential elastic cross-section data for neutrons. It is found that the successes of local optical models with energy-dependent parameters are largely preserved. Contrary to expectations, it is found that nonlocality tends to accentuate rather than wash out diffraction patterns. Although a diverse variety of experimental phenomena are treated, a range of parameter choices remains. Because of theoretical uncertainties as to the size of the "rearrangement energy," an effort is made to establish limits as to its magnitude on phenomenological grounds. The influence of several choices upon the physical phenomena used in adjusting the parameters of this model are shown. It would appear that this study does allow for a rearrangement energy but that it is rather small (<6 Mev) and comparable to the probable fluctuations of the potential from element to element. (auth)

22419

SINGLE-PARTICLE STATES IN DEFORMED NONLOCAL DIFFUSE BOUNDARY POTENTIALS. R. H. Lemmer (Florida State Univ., Tallahassee) and A. E. S. Green. Phys. Rev. 119, 1043-52(1960) Aug. 1.

Using the spherical wave functions generated in a previous investigation by Wyatt, Wills, and Green, the influence of spheroidal deformation is examined with the aid of perturbation theory. The combined calculations yield the energies of single-particle states for a diffuse boundary, nonlocal deformed potential. Specific calculations are performed for light nuclei around A = 25 and in the rare-earth region between A = 150 and A = 180. An analysis of nuclear ground-state spins and magnetic moments is presented in terms of the computed level schemes and wave functions. The results confirm the general aspects of the Nilsson, Mottelson results as obtained with adjusted harmonic oscillator potentials although some differences arise in detail. In particular, the calculated coefficients usually show less mixing of different angular momentum states in this case. The fact that the unperturbed potentials used in this calculation were obtained in the study of Wyatt, Wills, and Green from completely independent theoretical and experimental considerations is satisfying and further tends to confirm that the phenomenological model has a strong basis in reality. A discussion of the relationship of the phenomenological model to the self-consistent nuclear model of Brueckner is given. (auth)

22420

HYPERFINE STRUCTURE AND NUCLEAR MOMENTS OF 17-hr BROMINE-76. Edgar Lipworth, Thomas M. Green, Hugh L. Garvin, and William A. Nierenberg (Univ. of California, Berkeley). Phys. Rev. 119, 1053-60(1960) Aug. 1.

The nuclear spin, the nuclear magnetic-dipole interaction constant a, and the nuclear electric-quadrupole interaction constant b, were determined for 17-hr Br^{76} by an atomic-beam experiment. The results are: I = 1, $|a| = 345.422 \pm 0.014$ Mc/sec, $|b| = 314.329 \pm 0.022$ Mc/sec, $b/a = 0.9100 \pm 0.0001$. The nuclear magnetic-dipole and electric-quadrupole moments are calculated to be, respectively, $\mu = \pm 0.5479 \pm 0.0001$ nm, and $Q = \mp 0.27 \pm 0.01$ barn. The sign of μ, though not determined, is probably negative. The hyperfine structure separations are $\Delta\nu(\frac{5}{2},\frac{3}{2}) = 1256.47 \pm 0.05$ Mc/sec, and $\Delta\nu(\frac{1}{2},\frac{3}{2}) = 189.11 \pm 0.05$ Mc/sec. The hyperfine structure is of particular interest because the $F = \frac{1}{2}$ and $\frac{3}{2}$ levels are inverted and not in normal order. This inversion is the first case of its kind established in an atomic-beam experiment. (auth)

22421

EFFECTS OF CHEMICAL BINDING ON NUCLEAR RECOIL. M. S. Nelkin and D. E. Parks (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. 119, 1060-8(1960) Aug. 1.

The recoil of a chemically bound nucleus is considered for slow neutron scattering and for the resonant absorption of neutrons or gamma rays. The Doppler-broadened resonance line shape is derived in terms of the time-dependent self-correlation function describing the motion of a nucleus due to the interatomic forces. This explicitly relates the resonance line shape to the differential scattering cross section for slow neutrons in the Fermi

pseudopotential approximation. Within this formulation an expansion for large nuclear recoil is naturally suggested. For the case of a crystal, this expansion can be directly related to the expansion associated with the central limit theorem of probability theory and can therefore be proved to be asymptotic in nature. The expansion parameter is $(K_{av}/R)^{1/2}$, where K_{av} is the average kinetic energy of a nucleus and R is the recoil energy for a free nucleus at rest. The leading term of the expansion is the weak binding limit originally obtained by Lamb. In this limit the Doppler-broadened line shape is the same as would obtain for an ideal monatomic gas of the same mass with an effective temperature $T' = (2/3)K_{av}$. For noncrystalline systems, a similar expansion with the same leading term can be obtained by a rearrangement of the terms in an expansion used by Wick to study the slow neutron total cross section. The relation of the present expansion to Wick's expansion is discussed. (auth)

22422

CALCULATION OF α-TRANSITION PROBABILITIES. Hans J. Mang (Univ. of California, Berkeley). Phys. Rev. 119, 1069-75(1960) Aug. 1.

The decay rates for the ground-state transitions of all Pu isotopes and the odd-even At isotopes are discussed on the basis of the nuclear shell model. Good agreement with experimental data is obtained. In particular the behavior of the reduced width as a function of the neutron number around the magic number N = 126 is well reproduced. (auth)

22423

ANGULAR DISTRIBUTIONS OF $B^{10}(d,\alpha)Be^8$ REACTIONS FROM 0.6 TO 1.5 MEV. Robert L. Becker (Univ. of Kentucky, Lexington). Phys. Rev. 119, 1076-9(1960) Aug. 1.

Angular distributions of the two most energetic alpha-particle groups resulting from deuteron bombardment of B^{10} were measured at seven deuteron energies between 0.58 and 1.50 Mev. In addition to the usual pulse-height analysis of the detector output, pulse-decay analysis was also employed so that alpha particles could be distinguished from protons giving the same pulse size. The shapes of the angular distributions were somewhat energy dependent. Averaged over the range of energies studied, the angular distributions were not isotropic, the yield being slightly higher at back angles. (auth)

22424

EXCITATION CURVES AND ANGULAR DISTRIBUTIONS FOR $N^{14}(d,n)O^{15}$. Theo Retz-Schmidt and Jesse L. Weil (Rice Inst., Houston, Tex.). Phys. Rev. 119, 1079-84(1960) Aug. 1.

Excitation curves for the highest energy neutron group in the reaction $N^{14}(d,n)O^{15}$ were measured at $\theta_{lab} = 0$, 30, 90, and 164° for deuteron bombarding energies between 0.66 and 5.62 Mev. A pulse shape discrimination detector was used to eliminate the pulses due to γ rays from the neutron spectra. There is considerable resonance structure in the excitation curves, with the anomalies appearing at different energies for the different angles. The angular distribution of this neutron group was also measured at bombarding energies of 0.91, 1.17, 1.51, 1.88, 2.58, 3.13, 3.56, 4.36, 4.80, and 5.27 Mev. The shape of the angular distribution changes rapidly with energy at low bombarding energy, but above 3.5 Mev the shape becomes more stable. The maximum cross section at any angle was 5.5 millibarns per steradian. (auth)

22425

METHOD OF STUDYING THE ENERGY DEPENDENCE OF PHOTONUCLEAR REACTION CROSS SECTIONS WITH A SYNCHROTRON. R. G. Vasil'kov, B. B. Govorkov, and A. V. Kutsenko (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 23-6(1960) Mar.-Apr. (In Russian)

The energy dependence of photonuclear reaction cross sections was studied by a method based on the single-sign energy bond of electrons incident on a synchrotron target and, consequently, on the maximum bremsstrahlung energy. The design and performance of the device used are described. (tr-auth)

22426

PROTON EMISSION FROM NUCLEI DUE TO NEUTRON INTERACTIONS. G. S. Mani and K. G. Nair (Atomic Energy Establishment, Trombay, India). Proc. Indian Acad. Sci., Sec. A51, 243-57(1960) May. (In English)

The energy spectra of protons emitted in neutron bombardment of Al^{27} were analyzed in terms of the statistical model and volume direct interaction. It was found that the diffuseness of the nuclear potential or the form of level density used did not alter the shape of the energy spectra very much. The available experimental data agreed fairly well with theory. The contribution of direct interaction was found to be small and hence did not alter the general shape of the spectra. The direct interaction cross-section obtained from the measurements of the angular distribution in the case of iron and copper agreed reasonably well with theory. (auth)

22427

INTERFERENCE BETWEEN THE 930 KEV AND 980 KEV LEVELS IN THE 6.8 MEV GAMMA RAY YIELD FROM THE REACTION $Be^9(p,\gamma)B^{10}$. Lennart Simons (Univ. of Helsinki). Soc. Sci. Fennica, Commentationes Phys.-Math. 24, No. 8, 1-10(1960). (In English)

A unique case of overlapping of two levels in a (p,γ) reaction is investigated, the interference term being fully determined. The occurrence of this phenomenon was observed in the behavior of the gamma yield of the reaction $Be^9(p,\gamma)B^{10}$ for 850 kev $\leq E_p \leq$ 1050 kev, the gamma radiation going to the 0.72 Mev level in B^{10}. The proposed spin and parity values 1^+ for the 930 kev level and 2^+ for the 980 kev level have as the only possibility, p wave protons and M1 radiation. The yield is expressed in the form $W = C\ (1 + k \cos^2 \theta)$, where C and k depend on the proton energy. C is fairly independent of couplings while k depends strongly on the coupling. (auth)

22428

INVESTIGATIONS OF RECOIL NUCLEON ENERGY SPECTRA. Yu. T. Lukin. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 17-45(1960). (In Russian)

The theory of Geitler, Yanoski, and Messel postulates that collisions of primary nucleons with nuclear nucleons produce only one meson, hence the total number of mesons is determined by the number of primary particle collisions in passing through the nucleus. The relationship of the mean number of mesons produced to the primary particle energy, according to the multiple theory, is in good agreement with experimental data for primary particle energies of several Bev. However, experiments made with high-energy accelerators refute the theory. An attempt is made to find how the general concept of a nucleon cascade inside the nucleus agrees with the experimental data on nucleon recoil at primary particle energies of 5 to 20 Bev. The distribution of recoil nucleons from the spallation of emulsion nuclei by cosmic rays was analyzed as a means of clarifying the above problem. Studies of tungsten and aluminum spallation by cosmic rays showed that in aluminum

spallation the mean energy of cascade protons is larger than in tungsten spallation, which is in good qualitative agreement with the concept. Quantitative calculations on nucleon showers according to Serber and Goldberger produced a larger number of aluminum spallation protons than was observed experimentally. Spallation of emulsion nuclei by 10^{10} ev cosmic rays indicates qualitative agreement with the concept of cascade production by primary particles in the nucleus. 57 references. (R.V.J.)

22429

AN ANALYSIS OF HIGH-ENERGY NUCLEAR INTERACTIONS. Zh. S. Takibaev, A. Kh. Vinnitskiĭ, and K. G. Zaitsev. Trudy Inst. Yadernoĭ Fiz., Akad. Nauk Kazakh. S.S.R. 3, 100-5(1960). (In Russian)

The general scheme is presented of a powerful shower found in an emulsion stack consisting of 40 films. The stack was exposed at 30 to 33 km elevation for nine hours. A shower (with 61 minimum ionized tracks) with its center outside the emulsion was observed in the first film. The shower crossed 36 emulsion films and one 0.5 mm aluminum film, leaving the boundaries of the stack. The mean length of the tracks in each film is 2 mm. The charged particles, generated in the first collision, produced nine secondary interactions. Secondary interactions produced by neutral particles were not observed. The location of the first interaction and the number of charged particles produced were found, and the energy of the secondary interactions was evaluated. The angular distributions of particles in the initial and secondary interactions were plotted and analyzed. (R.V.J.)

22430

RELATION BETWEEN THE NUMBER OF NUCLEONS AND MASS NUMBER OF AN ISOTOPE. Tsin-sun Wang. Tung Chi Ta Hsüeh Hsüeh Pao 3, No. 10, 38-41(1958). (Translated from Referat. Zhur. Fiz. No. 2, 1960, abstract No. 2977).

By investigating the number of nucleons in almost all the isotopes (approximately 700), the following was established: the product of the "concentration" of the protons by the "concentration" of the neutrons is constant, i.e., (Z/A) (N/A) = K. From the relation obtained it is concluded that the product of the number of protons and neutrons contained per unit volume is constant and that the volume of an atomic nucleus is proportional to the square root of the product of the number of protons and neutrons.

22431

ISOMERIC STATES OF ODD-ODD NUCLEI FROM THE POINT OF VIEW OF A COLLECTIVE MODEL. A. K. Val'ter, I. I. Zalyubovs'kiĭ, G. Yu. Krivets, and V. P. Lutzik. Ukraïn. Fiz. Zhur. 4, 689-96(1959) Nov.-Dec. (In Ukrainian)

It is shown that the difficulties encountered in the explanation of nuclear isomerism on the basis of a shell model may be removed if the conception of a collective model is accepted. (auth)

22432

COLLECTIVE MODEL DESCRIPTION OF GROUND STATES OF NUCLEI WITH MEDIUM ATOMIC WEIGHT. A. K. Val'ter, I. I. Zalyubovs'kiĭ, and V. P. Lutzik. Ukraïn. Fiz. Zhur. 4, 697-707(1959) Nov.-Dec. (In Ukrainian)

The experimental data concerning nuclei of medium atomic weight are analyzed on the basis of a collective model. Equilibrium deformations of nuclei in this region are calculated. Theoretical predictions for spin, parity magnetic dipole, and electric quadrupole moments are compared with the experimental data and with the theoretical values given by the shell model. The conclusion is that the collective nuclear model may be used for the description of ground states of nuclei with medium atomic weight. (auth)

22433

ELASTIC SCATTERING OF HIGH ENERGY ELECTRONS BY C^{12}. Sing-nan King (Inst. of Atomic Energy Research, Academy of Sciences, China). Uli syuebao, Acta phys. sinica 15, No. 1, 25-31(1959). (Translated from Referat. Zhur. Fiz. No. 11, 1959, abstract No. 24460).

The elastic scattering of high energy electrons from the C^{12} nucleus was considered. The following distributions of the charge in the C^{12} nucleus were used in the computation: exponential, Gaussian, and uniform. The results of calculations for electron energies of 187 Mev show that the Gaussian distribution agrees best with the experimental data. The radius of the C^{12} nucleus is found to be $R = (12)^{1/3} r_0$, where $r_0 = 1.35 \times 10^{-13}$ cm.

22434

THE OVERHAUSER EFFECT AND ALLIED PHENOMENA. G. R. Khutsishvili. Uspekhi Fiz. Nauk 71, 9-69(1960) May. (In Russian)

An analysis is made of resonance saturation, paramagnetic resonance hyperfine structure, and contact interactions of electron and nuclear spins. The Overhauser effect with total saturation of all components in metals, in liquid or solid diamagnetics with paramagnetic admixtures, and in paramagnetic salts and semiconductors was studied as well as in alkali halide crystals and alkali ammonium solutions. The Overhauser effect is discussed from the standpoint of statistical physics and thermodynamics. 98 references. (R.V.J.)

22435

MOMENTS OF INERTIA ACCORDING TO INGLIS AND THE BOHR-VAN LEEUWEN THEOREM. Gerhart Lüders (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. 15a, 371-7(1960) May-June. (In German)

It has been stated by Bohr and Mottelson that Inglis' method for the theoretical determination of moments of inertia of deformed nuclei, in the limit of a great number of non-interacting particles, leads to the moment of inertia of rigid rotation. Recently doubts have been raised regarding the general validity of this statement. The proof of the assertion is given in detail, and its relation to the Bohr–van-Leeuwen theorem is discussed. (auth)

22436

THE RESONANCE SPECTRUM OF THE NUCLEAR SPIN OF Na^{23} IN SINGLE CRYSTALS OF SODIUM NITRATE, $NaNO_2$. Alarich Weiss (Technische Hochschule, Darmstadt, Ger.). Z. Naturforsch 15a, 536-42(1960) May-June. (In German)

The quadrupole coupling constant was determined at room temperature in single crystals of $NaNO_2$. The value obtained was $|e^2qQ/h| = 1100.3 \pm 0.8$ kHz. The symmetry parameter $\eta = (\phi_{xx} - \phi_{yy})/\phi_{zz}$ is 0.1092 ± 0.0009. The principal axis of the quadrupole coupling tensor coincides with the orthorhombic crystal axis so that the maximum field gradient lies parallel to the polar axis (c axis). A relationship exists between the mosaic structure of the crystal and the line width of the nuclear resonance, which depends on the angle between the magnetic field H_0 and the principal axis of the quadrupole coupling tensor. (tr-auth)

22437

BETA DECAY OF P^{32}. B. V. Geshkenbeĭn. Zhur. Eksptl'. i Teoret Fiz. 38, 1341-2(1960) Apr. (In Russian)

Beta transition in P^{32} is a permitted transition $1^+ \rightarrow 0^+$. The shape of the P^{32} β spectrum should be Fermian. How-

ever, experiments showed small deflection from the Fermi spectra shape and from the polarization magnitude. An attempt is made to explain the discrepancy. (R.V.J.)

22438

ON THE ELASTIC SCATTERING OF PHOTONS BY COULOMB NUCLEAR FIELD. K. Eftimiu and K. Vrezhoiu (Parhon Univ., Bucharest). Zhur. Eksptl'. i Teoret. Fiz. 38, 1348-50(1960) Apr. (In Russian)

The cross sections of photon elastic scattering by nuclear Coulomb fields are in the range of zero or very small angle (of one degree magnitude) and high energies (of tens or hundreds of Mev), while all the experiments for finding the above effect are carried out at angles exceeding 15 to 20° and energies of Mev order. Two approximation methods are suggested which fit better the required conditions. (R.V.J.)

22439

BETA AND GAMMA SPECTRA OF Sb^{113} AND Sb^{115} ISOTOPES. V. L. Chikhladze, D. E. Khulelidze, and I. P. Selinov. Zhur. Eksptl'. i Teoret. Fiz. 38, 1353(1960) Apr. (In Russian)

Betta and gamma spectra of Sb^{113} and Sb^{115} were investigated with a double-focusing β spectrometer. The positron spectra of Sb^{113} consisted of two components with upper boundaries 1.85 ± 0.02 and 2.42 ± 0.02 Mev; for Sb^{115} it is 1.51 ± 0.02 Mev. A gamma line at 0.499 ± 0.002 Mev was found in the Sb^{115} conversion electron spectra. Eight γ lines were found in the Sb^{113} spectra. (R.V.J.)

22440

NUCLEAR PHOTO-DISINTEGRATION. J. S. Levinger. Oxford Library of the Physical Sciences. New York, Oxford University Press, 1960. 148p. $2.00.

Discussions are presented of calculational methods for atomic and nuclear photoeffects; deuteron photoeffect; sum-rule calculations for nuclear photodisintegration; systematics of radiative transitions between discrete states; shell model and collective model calculations of the cross section for nuclear photodisintegration; and statistical model, direct interaction model, and quasi-deuteron model calculations of nuclear photodisintegration products. (B.O.G.)

22441

COBALT-60 AND CAESIUM-137 GAMMA SOURCES. E. E. Kulish and G. M. Fradkin (Academy of Sciences, USSR, Moscow). p.149-62 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In Russian)

The main technical characteristics of gamma sources produced in the USSR using cobalt-60 and cesium-137 and some of the problems of their production technology are discussed. Information is given on the radiation spectra of Co^{60} and Cs^{137} and the source material from which they are prepared. Data are given on the dependence of the activity of cobalt sources upon the intensity of the neutron beam and the geometrical size of the sample. The yield of cesium by uranium fission is also analyzed. The problem of hermetic sealing of the sources is discussed and a complete nomenclature of all the sources manufactured in the USSR are listed, their size and activity also being indicated. In conclusion a comparison of Co^{60} and Cs^{137} sources is made. (auth)

22442

SOME PROBLEMS OF CALCULATION AND DESIGN OF HIGH-ACTIVITY GAMMA UNITS. A. V. Bibergal, N. I. Leshchinskiĭ, U. Ya. Margulis, and V. G. Khrushchev (Academy of Sciences, USSR, Moscow). p.163-77 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In Russian)

The principal requirements for gamma units intended for various purposes are described. Several methods of calculating the dose fields for various forms of irradiators are given, as well as graphs, nomograms and formulas to estimate the amount of gamma-ray dose absorbed by the irradiated object from cobalt-60 and cesium-137. Some of the calculated data were confirmed by experiment. The advantages of irradiators of various geometry employed in experimental and commercial units are discussed. The irradiation technique for various objects is analyzed and the optimum irradiation conditions (radiation utilization factor, dose field homogeneity, etc.) are discussed. Several rational shielding systems are suggested to simplify irradiation process and recharging and to reduce the cost of design and operation. (auth)

Particle Accelerators

22443 CERN-60-22

European Organization for Nuclear Research, Geneva. ACHROMATIC BEAM OPTICS FOR PARTICLE SEPARATOR. S. van der Meer. June 1, 1960. 21p.

The maximum momentum at which a particle separator can give a useful separation is partly determined by the aberrations of the associated beam transport system. The various factors limiting the image sharpness are discussed. It is shown how the chromatic aberration of the lenses can be compensated by using a sextupole lens in combination with a momentum-analyzing magnet. A description is given of two possible beam transport systems for the CERN electrostatic separator, these designs aim at a maximum momentum value of 6 and 8 Bev/c, respectively (separation of anti-protons and π mesons). (auth)

22444 MURA-569

Midwestern Universities Research Assn., Madison, Wis. THE PRODUCTION BY SURFACE CURRENTS OF MAGNETIC FIELDS SUITABLE FOR SPIRAL RIDGE ACCELERATORS. Edward S. Akeley. Apr. 15, 1960. 32p. Contract AT(11-1)-384. OTS.

The problem of finding surface current distributions required to produce magnetic fields suitable for spiral ridge accelerators is treated, where the field is required to be zero outside the region of the current distributions and where media of two different permeabilities are used. The problem is reduced to the design of an "elementary magnet." The final accelerator magnet can be formed of a single such magnet or built up using a number of them. (auth)

22445 MURA-575

Midwestern Universities Research Assn., Madison, Wis. ACCELERATION ACROSS TRANSITION ENERGY. G. Bronca. May 26, 1960. 17p. Contract AT(11-1)-384. OTS.

Study of the phase motion across transition energy shows that the non-linear term has an important effect. To avoid increase in amplitude of synchrotron oscillation, the shift of the stable point should occur when the energy is very close to the transition energy and with a program keeping the linear approximation valid as long as possible. Computer study agrees with these results. When the above requirements are fulfilled, the final bucket area increases less than 20% for an initial area $A_i = 0.3\ A_c$, A_c being the maximum bucket area near transition. (auth)

22446 NP-8814(p.14-16)
Naval Research Lab., Washington D. C.
SOLUTIONS OF THE BOLTZMANN EQUATION FOR AN ELECTRON GUIDE-FIELD ACCELERATOR WITH IMPERFECTIONS IN THE EXTERNAL-FOCUSING MAGNETIC FIELD. J. B. Ehrman.

The problem considered is the determination of the effect of imperfections in the external-focusing magnetic field of an electron guide-field accelerator on the quasi-stationary solution previously obtained for a perfectly constructed guide field. The possible instabilities due to resonances between transverse oscillation frequencies and longitudinal circulation frequencies of electrons are investigated. (W.D.M.)

22447 UCRL-9221
California. Univ., Berkeley. Lawrence Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT. XXV. [Period covered] February, March, April 1960. Walter D. Hartsough. June 7, 1960. 10p. Contract W-7405-eng-48. OTS.

Bubble chambers were used in the secondary beams of the Bevatron to investigate $\pi^{\pm}$ interactions in hydrogen and K^{-} interactions in propane, and to measure the $\theta_1 - \theta_2$ mass difference. Counter experiments were made to study the interactions of K^{-}, $\pi^{\pm}$ and μ mesons. Three bombardments were made in the primary beam for the Chemistry Group. (For preceding period see UCRL-9220.) (auth)

22448 CEA-tr-R-791
INFLUENCE DES CHAMPS DE FUITE SUR LES OSCILLATIONS BÉTATRONIQUES DANS UN ACCÉLÉRATEUR À CHAMP AZIMUTALEMENT DISCONTINU. (Effects of Dispersion Fields on Betatron Oscillations in an Accelerator with an Azimuthally Discontinuous Field). Jiri Teichman. Translated into French from Czechoslov. J. Phys. 9, 388-94(1959). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 5707.

22449 JPRS-5063
CONFERENCE ON ELECTRON ACCELERATORS. V. N. Timov. Translated from Izvest. Vysshikh Ucheb. Zavedenií, Fiz. No. 1, 241-3(1960). 12p. OTS.

A brief discussion is presented on certain papers presented at the Russian Conference on "Electron Accelerators and Their Practical Application." (C.J.G.)

22450
THE CERN PROTON SYNCHROTRON: INSTALLATION OF HIGH PRECISION. André Decae and Jean Gervaise (Institut géographique national, Paris). Inds. atomiques 4, 5-6, 61-73(1960). (In French)

Modern techniques, which demand more and more precise installations, lead to the perfection of the usual topometry methods and to the transformation of the existing geodesic instruments in order to adapt them to these demands. These perfections are reviewed by taking as an example the installation of the CERN proton synchrotron. The installation must be accompanied by detailed studies on the stability of different foundation terrain layers. Some indications are given on the eventual installation of new devices. (tr-auth)

22451
DYNAMICS OF THE SECTOR EFFECTIVE ANGLE IN ACCELERATOR WITH RECTILINEAR REGIONS. V. N. Eponeshnikov, V. P. Kirrilov, V. N. Kuz'min, and Yu. P. Petrov (Inst. of Scientific Research, Kirov Tomisk Polytechnic Inst., USSR). Izvest. Vysshikh Ucheb. Zavedenií, Fiz. No. 1, 139-44(1960). (In Russian)

The influence of vortex currents and saturation on the effective angle of accelerator sectors with rectilinear regions was studied. An analysis is made of data obtained with an electromagnetic model and of the influence produced by the variations of sector effective angles on the particle acceleration process. The effects of sector angle at the end of the acceleration cycle is small, and the related losses in radial working region and maximum energy are negligible. The described effect does not disturb the performance of the accelerator, and the position of the effective orbit is determined by acceleration frequency. The slow energy level motion is corrected by an autophasing mechanism. (R.V.J.)

22452
VAN DE GRAAFF GENERATOR OF TWO MILLION VOLT RATED VOLTAGE. Sándor Szalay, Emil Puskás, Ede Koltay, and János Félszerfalvi. Magyar Tudományos Akad. Atommag Kutató Intézete (Debrecen), Közlemenyek 2, 3-14 (1960). (In Hungarian)

The Van de Graaff generator of 2 Mv rated voltage constructed at the Institute of Experimental Physics of L. Kossuth University, Debrecen, is described. The generator has a novel suspended construction. The charging belt is placed between the suspenders, which are made of bakelit paper tubes (Ganz-Pabit) rendered electrostatically insulating by impregnation with resin and ceresin in vacuum. The suspended arrangement guarantees advantageous potential distribution above the generator. The improved self-charging system of the belt insures stable charging conditions up to a short circuit current peak value of 465 μA. The four-stage accelerating tube consists of cylindric immersion ionoptical lenses. The electrical, electron-optical and vacuum technical problems and their solutions are discussed. (auth)

22453
LOW-COST ELECTRONS: THREE MANUFACTURERS OFFER NEW ACCELERATORS. I. DYNAMITRON–A HIGH-POWER ELECTRON ACCELERATOR. Marshall R. Cleland and Kennard H. Morganstern (Radiation Dynamics, Inc., Westbury, N. Y.). Nucleonics 18, No. 8, 52-3(1960) Aug.

The design characteristics of the Dynamitron are described. The use of this accelerator is expected to reduce the electron-irradiation costs to ~$1/kwh. This applies to a 1.5-Mev, 15-kw model at a cost of $76,000 and uses the following assumptions: (1) five-year straight-line amortization; (2) a facility with primary shielding, cooling, ventilation, and power but without a conveyor; (3) one full-time operator per shift; (4) complete tube replacement every 4000 hr; and (5) beam tube replacement every 500 hr. The simplicity of design, freedom from moving parts, and use of overrated components contribute to the performance reliability of the Dynamitron. Second generation accelerators of 100-kw power level are anticipated with which the cost is expected to be ~10 to 25¢/kwh. (B.O.G.)

22454
LOW-COST ELECTRONS: THREE MANUFACTURERS OFFER NEW ACCELERATORS. II. THREE HIGH-POWER ACCELERATORS FOR RADIATION PROCESSING. Nucleonics 18, No. 8, 54-5(1960) Aug.

The design characteristics of three types of accelerators designed for radiation processing are described. These types are: the insulating-core transformer, the transmission-line accelerator (Magnaline), and the multiple-disk accelerator. All appear to be appropriate for electron energies to 4 Mev, beam currents greater than 15 ma, and electron-irradiation costs of less than

$1/kwh at power levels of 10 to 1000-kw. As accelerators like this are extended to very high power, existing acceleration-tube techniques become inadequate. The inadequacy of these techniques is being investigated. The use of one generator with several acceleration tubes is being considered. (B.O.G.)

22455

LOW-COST ELECTRONS: THREE MANUFACTURERS OFFER NEW ACCELERATORS. III. NEW LINACS HAVE GREATER POWER, SMALLER COSTS. Nucleonics 18, No. 8, 56-7(1960) Aug.

In the pure and applied sciences new developments in microwave electron linear accelerators are extending the usefulness of these devices. Among improvements of technology that are leading to new advances are: (1) more powerful and reliable power tubes; (2) development of lower frequency "L-band" linacs; and (3) improvement of "S-band" design power capabilities. The "L-band" frequency is 1300 Mc/sec while that of the "S-band" is 2856 Mc/sec. (B.O.G.)

22456

CALCULATIONS OF PARTICLE LOSSES BY GAS, CONSIDERING ADIABATIC BEAM COMPRESSION. L. L. Gol'din (Inst. of Theoretical and Experimental Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 2, 14-15(1960) Mar.-Apr. (In Russian)

Particle losses in scattering were previously calculated for ordinary and strong-focusing accelerators. However, losses for adiabatic beam compression were not accounted for. The problem of beam losses, considering the adiabatic beam compression in a spherical chamber (two-dimensional problem), is resolved in relativistic approximation. (R.V.J.)

22457

HIGH-VOLTAGE SUPPLY OF DEFLECTOR PLATES OF ION BEAM INJECTION INTO SYNCHROPHASOTRON CHAMBER AT 10 BEV. G. A. Zeitlenok, L. P. Zinev'ev, and I. M. Rolfe. Pribory i Tekh. Ekspt. No. 2, 16-20(1960) Mar.-Apr. (In Russian)

Problems related to high-voltage supply to the deflector plate system in ion beam injection into the 10-Bev synchrophasotron are analyzed. The basic parameters of the installation are calculated. (tr-auth)

22458

ELECTRON ACCELERATOR INJECTOR. I. M. Samoilov. Pribory i Tekh. Ekspt. No. 2, 21-3(1960) Mar.-Apr. (In Russian)

Descriptions are given of an experimental injector for betatrons and synchrotrons. The device offers practically parallel electron beams with angular divergence varying up to 15 to 20°. The beam emergence angle is controlled by the asymmetric electrode distribution. (tr-auth)

22459

FUNCTION OF A HIGH TENSION CASCADE GENERATOR. E. J. Bertomeu and C. A. Mallmann. Publs. com. nacl. energía atómica (Buenos Aires) Misc. No. 1, 1-16(1954). (In Spanish)

A general formula is given to calculate the voltage drop and ripple in a high-tension cascade generator. The particular case of an instrument which uses mercury vapor rectifers is considered taking into account the advantages and disadvantages of these and other types of rectifiers. (W.L.H.)

22460

THE MODULATION OF LINEAR ACCELERATORS OF HEAVY PARTICLES BY MEANS OF SLOW ELECTRONS. Ya. B. Fainberg and O. M. Nekrashevich (Physico-Technical Inst., Academy of Sciences, Ukrainian SSR). Ukraïn. Fiz. Zhur. 4, 803-4(1959) Nov.-Dec. (In Ukrainian)

A principle for modulating heavy particle linear accelerators is described which is particularly useful in the early stages of accelerator construction and in quickly checking accelerator parameters at high energies. The method utilizes slow electrons in place of the heavy particles and is based on the principle of similarity. The velocity of the electrons must be equal to the velocity of the heavy particles and therefore low energy electrons are required. Conversely there is then no need for high voltage injectors or high power frequency generators, and control of the accelerator is simplified. Conditions analogous to high heavy particle energies may be easily obtained. The phase and radial stability of the accelerator may thus be checked. (TTT)

22461

ORBIT STABILITY IN CIRCULAR ACCELERATORS. Jøchen Biersack (Freie Universität, Berlin). Z. angew. Phys. 12, 262-75(1960) June. (In German)

22462

VACUUM TECHNIQUES AND COMPONENTS USED FOR A CONTINUOUSLY PUMPED LINEAR ELECTRON ACCELERATOR. R. C. Marker (Applied Radiation Corp., Walnut Creek, Calif.). p.493-8 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In English)

A vacuum system was designed to continuously pump a linear electron accelerator having an internal volume of approximately 30 l and produce vacuums down to 1×10^{-6} or better. The construction avoids all organic materials and is capable of being baked out at 450°C; design details of flanges, envelope construction, insulators and valves are discussed. Performance of the diffusion pump traps, which require no refrigeration, and their construction are described. Operating characteristics of the over-all system are discussed in terms of accelerator performance. (auth)

22463

THE VACUUM SYSTEM OF THE CERN PROTON SYNCHROTRON. PART I. INTRODUCTION AND THE VACUUM CHAMBER. G. L. Munday (European Organization for Nuclear Research, Geneva). p.499-503 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In English)

A brief outline of the vacuum requirements of the CERN 25 Bev alternating gradient proton synchrotron is given. The mean air pressure in the chamber should be 1×10^{-6} Torr. The parts of the vacuum chamber are discussed in general. The chamber is largely composed of elliptical section tubes of axes 150 mm × 70 mm with a perimeter of about 600 m. Details are given of the design considerations for the one hundred magnet vacuum chambers which follow the 70 m radius of curvature of the magnet units and must not introduce any appreciable errors in the magnetic field. A number of possible solutions for the magnet chamber is outlined along with details of the chamber that is in production. (auth)

22464
AUTOMATION OF HIGH-VACUUM INSTALLATIONS WITH SPECIAL REGARD TO CONDITIONS PRESENT IN A CIRCULAR ACCELERATOR. R. Haefer. p.508-13 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In German)

The mode of operation of a series of newly developed control instruments for automation of pump stations is described, especially vacuum indicators for high and fine vacuums. An example of a pump station is given to show the interworking of these controls with the pneumatic or magnetic valves of the fully automatic output of a pump process and in the protection of the plant against accidents of different kinds. The electrical circuit is so designed that the automatic output can also be set in addition to the power, and optional starting of a single element is possible. (tr-auth)

22465
AUTOMATIC PUMP STATION FOR PARTICLE ACCELERATORS. H. Meyer. p.520-5 of "Advances in Vacuum Science and Technology. Proceedings of the First International Congress on Vacuum Techniques, 10-13 June 1958, Namur, Belgium. E. Thomas, ed. Volume I. Fundamental Problems in Vacuum Techniques, Ultra-High Vacuum. Volume II. Vacuum Systems Applications in Various Sciences and Techniques." New York, Pergamon Press, 1960. (In German)

A study was made of the electrical and constructional means by which a complete pump station and an accelerator tube could work together harmoniously and without disturbance. It was suggested on the basis of error probability and the shortest possible dead-time for repairs that an extensive separation between the pump station and its electrical connections and controls be developed. It was further indicated, as the information from a single switch box can be extended by a coincidence technique, that the total vacuum system can act as a remote-control, manual, or automatic pump station. The behavior of the single pump station and its automatics is not discussed. (tr-auth)

22466
LINEAR ACCELERATOR. N. C. Christofilos and I. J. Polk (to U. S. Atomic Energy Commission). U. S. Patent 2,874,326. Feb. 17, 1959.

Improvements in linear particle accelerators are described. A drift tube system for a linear ion accelerator reduces gap capacity between adjacent drift tube ends. This is accomplished by reducing the ratio of the diameter of the drift tube to the diameter of the resonant cavity. Concentration of magnetic field intensity at the longitudinal midpoint of the external surface of each drift tube is reduced by increasing the external drift tube diameter at the longitudinal center region.

Plasma Physics and Thermonuclear Processes

22467 AD-233991
Stevens Inst. of Tech., Hoboken, N. J.
MEGATRON ACCELERATOR PROGRESS REPORT—INVESTIGATION OF PLASMA ACCELERATION. Quarterly Progress Report No. 6 [for] October 1, 1959–December 31, 1959. K. C. Rogers, D. Finkelstein, G. Brucker, L. Ferrari, I. Mansfield, and D. Caulfield. 24p. Sponsored by AEC and Army Signal Supply Agency under contract DA 36-039SC-78097. OTS.

Some results of further theoretical work on the Megatron beam are summarized. Possible instabilities are listed and stability criteria are given. The instabilities considered are single-particle magnetic guide field resonances, kink hydrodynamic instability, "negative mass" instability, and the two stream instability. (auth)

22468 BRL-1063
Ballistic Research Labs., Aberdeen Proving Ground, Md.
CYLINDRICAL SHOCK WAVES FROM EXPLODED WIRES OF HYDROGEN-CHARGED PALLADIUM. F. D. Bennett. Jan. 1959. 23p. DA Project No. 503-03-001.

The analogy of an electrically exploded wire to a shock tube of radial symmetry suggests that wires of Pd charged with hydrogen should show greater effectiveness as shock producers than simple metal wires. Experimental tests of this hypothesis indicate that the presence of hydrogen probably causes shock wave initiation at earlier times than when hydrogen is absent; consequently higher Mach numbers and concomitantly, more prominent luminous effects are produced by hydrogen charged wires. Special platings of Cu or Au are found necessary in order to retain the hydrogen within the wire for a sufficient length of time during the early phases of the explosion. The composite wires possess complicated effective resistances which adversely affect the transfer of energy from electrical to fluid mechanical form. (auth)

22469 CF-60-8-22
Oak Ridge National Lab., Tenn.
PLASMA DENSITY IN DCX AS A FUNCTION OF ARC DENSITY. E. D. Shipley and T. K. Fowler. Aug. 3, 1960. 6p. OTS.

It is shown that there is an optimum density for the arc employed in dissociating molecular ions injected into DCX such that the trapped atomic ion density is maximum. (auth)

22470 LA-2408
Los Alamos Scientific Lab., N. Mex.
PLASMA PROPULSION STUDIES—SUMMER, 1959. M. E. Ebel, N. M. Kroll, C. L. Longmire, F. E. Low, E. N. Parker, John R. Reitz, and S. B. Treiman. July-Sept. 1959. 140p. Contract W-7405-Eng-36. OTS.

A collection of papers written in the Theoretical Division at the Los Alamos Scientific Laboratory in the Summer of 1959 is presented. The results obtained are somewhat tentative, as there is no experimental verification of the ideas discussed. Separate abstracts were prepared for the five papers. (W.D.M.)

22471 LA-2408(p.7-15)
Los Alamos Scientific Lab., N. Mex.
THE POTENTIALITIES OF PLASMA PROPULSION. C. L. Longmire.

Experiments made in the last few years have made it clear that one can accelerate plasma, by electromagnetic means, to velocities greater than 100 km/sec. The use of plasma accelerators as propulsive devices for rockets is considered, and the problems and prospects of this idea are summarized. (W.D.M.)

22472 LA-2408(p.16-25)
Los Alamos Scientific Lab., N. Mex.
STABILITY OF A PLASMA SHEATH. M. E. Ebel and S. B. Treiman.

When an electric field is applied to a plasma, neutralizing charges tend to accumulate at the electrodes and shield out

the field in the bulk of the medium. This dielectric property of plasma can lead to a severe reduction of effective field strength. The question arises however as to the stability of such neutralizing sheaths. The sheath stability is discussed in connection with a simple and highly idealized model of sheaths which has been described by Longmire. (W.D.M.)

22473 LA-2408(p.26-97)
Los Alamos Scientific Lab., N. Mex.
A PRELIMINARY THEORETICAL STUDY OF A HIGH DENSITY PLASMA PROPULSION UNIT. E. N. Parker.

The design of a propulsion unit using a high-density plasma and delivering 10^8 dynes of thrust with an exhaust velocity of 30 km/sec is considered. A lithium plasma at $10^{4\circ}$K and density in excess of $10^{15}/cm^3$ appears to satisfy the necessary conditions that the collision frequency exceed the cyclotron frequency, without requiring prohibitive current densities and Joule losses. Parallel electrodes and tapering of the electrode spacing to obtain higher efficiency are considered. (W.D.M.)

22474 LA-2408(p.98-134)
Los Alamos Scientific Lab., N. Mex.
A HYDROMAGNETIC PLASMA PROPULSION DEVICE. N. M. Kroll and F. E. Low.

The design of a plasma propulsion system is considered in which the acceleration mechanism is hydromagnetic rather than resistive. The mechanism is analogous to that in hydrodynamic nozzle flow, with particle pressure replaced by magnetic pressure. The main advantage of such a design over a conventional nuclear or chemical rocket engine evidently lies in the possibility of achieving 3×10^6 cm/sec at a temperature of 3000°K. (W.D.M.)

22475 LA-2408(p.135-143)
Los Alamos Scientific Lab., N. Mex.
HEAT CONDUCTION IN THE PLASMA PROPULSION TUBE. John R. Reitz.

In high-density plasma propulsion devices the transverse electric current through the plasma interacts with its own magnetic field producing a JXB thrust which moves the plasma down the tube. The collision-dominated regime where the current flow is purely transverse is considered. The transverse temperature distribution in the plasma in these devices must be determined. The longitudinal mass motion is disregarded, and only the related electric and thermal conduction in the transverse direction is considered. (W.D.M.)

22476 LAMS-2416
Los Alamos Scientific Lab., N. Mex.
DEVELOPMENT OF RELIABLE 20 KV, SIZE A IGNITRONS FOR THERMONUCLEAR RESEARCH. G. P. Boicourt, E. L. Kemp, and F. K. Tallmadge. Dec. 1959. 46p. Contract W-7405-eng-36. OTS.

Development of ignitrons which could be used reliably as high-voltage, high-current switches in thermonuclear research is summarized. The development for Zeus application is V = 20 kv, I_{peak} = 30,000 amperes ringing at 5 kc with an 85% voltage reversal. The General Electric Z-5385 size A ignitron was developed under this contract and meets the Zeus application with a 99.9% reliability factor. During the evaluation of tubes it was shown that cooling the cathode of an ignitron greatly improved the tube's high voltage reliability. (auth)

22477 NP-8904
Massachusetts Inst. of Tech., Cambridge. Naval Supersonic Lab.
PRESSURE DATA OBTAINED FROM A CONTINUOUSLY FLOWING PLASMA. Technical Report 319. Charles F. Talbot. Jan. 1960. 25p.

Data are presented on the static pressure profile associated with the continuous flow of partially ionized helium through a tubular test section. The data are insufficient to fix the state of the flow. Several hypotheses are advanced to explain the behavior. (auth)

22478 NP-8905
Massachusetts Inst. of Tech., Cambridge. Naval Supersonic Lab.
A PRELIMINARY EXPERIMENTAL STUDY OF SKIN FRICTION IN MAGNETOGASDYNAMICS. Technical Report 396. Thomas McClimans. Oct. 1959. 84p.

The theory of hydromagnetics and its application to skin friction forces are discussed. With a continuous flow plasma jet, experiments were conducted for the flow of high-temperature air in a circular tube. The friction forces were determined by pressure drops along the tube. Fluid temperatures in the experiments ranged from 6,000 to 8,000°R, which gave low Hartmann numbers. Feasibility of further experiments in the ionized gas region is discussed. (auth)

22479 TID-6359
Stevens Inst. of Tech., Hoboken, N. J.
INVESTIGATION OF PLASMA ACCELERATION. Quarterly Progress Report No. 1 for June 30, 1958—September 30, 1958. K. C. Rogers, D. Finkelstein, G. Brucker, L. Ferrari, and I. Mansfield. 42p. Sponsored by AEC and Army Signal Supply Agency under Contract DA 36-039SC-78097. OTS.

The design of a 100,000 joule low inductance capacitor bank is given in detail. The system of capacitors, transmission lines, switches, and load is analyzed, and the results for the complete bank are presented. The bank utilizes a special 1 mf 50 kv low inductance capacitor and vacuum-gap low inductance switches. The switches are capable of switching 100,000 a currents and of standing off 50 kv voltages. Ringing frequency measurements were made on a section of the bank. The measurements agree well with the results of the circuit analysis. The short circuit electrical parameters of the 100,000 joule bank are given. Modifications necessary to increase the energy storage to 1,000,000 joules are outlined and a design for a 1,000,000 joule bank is presented. (auth)

22480 UCRL-5885
California. Univ., Livermore. Lawrence Radiation Lab.
TABLES OF FUNCTIONS INVOLVED IN LINEAR PINCH STABILITY CRITERIA. John Killeen, William A. Newcomb, and James S. Vandergraft. Mar. 15, 1960. 10p. Contract W-7405-eng-48. OTS.

Stability criteria for the linear pinch were derived previously. These criteria involve a certain function $F(x,\alpha)$, which must be evaluated over an infinite range of x values for each individual configuration. This function is tabulated. (auth)

22481 WADD-TR-59-486(Pt. IV)
Massachusetts Inst. of Tech., Cambridge. Naval Supersonic Lab.
FINAL REPORT ON RESEARCH IN A COMPREHENSIVE THEORY OF PLASMA STATES AND PHENOMENA. Mar. 1960. 79p. Project No. 7073. Contract AF33(616)-5693. (MIT-NSL-TR-441). OTS.

The thermodynamic state equation of a plasma, the influence of the magnetic field on the transport properties, and thermodynamic state, and elementary fluid flow problems are summarized. (auth)

22482

PLASMA MOTION IN MOVING MAGNETIC FIELD. V. G. Stepanov, V. F. Zakharchenko, and V. S. Bezel (Kirov Urals Polytechnic Inst., USSR). Izvest. Vysshikh Ucheb. Zavedenii, Fiz. No. 1, 104-14(1960). (In Russian)

An equation was solved for describing charged particle motion in a rotating magnetic field. The motion of an ionized gas in a rotating field with frequency less than Larmor's frequency was analyzed in hydrodynamic approximation. The centrifugal formula was derived on the basis of magnetohydrodynamic approximation. Experimental studies of discharge plasma in rotating fields confirm the calculations. The approximate evaluation of forces acting upon the visually observed air vane showed rotation similar to that in a conducting liquid. (tr-auth)

22483

COHERENT SCATTERING IN PLASMA. V. N. Kessenikh (Siberian Inst. of Physics and Tech., Kuibyshev Tomsk Univ., USSR). Izvest. Vysshikh Ucheb. Zavedenii, Fiz. No. 1, 234-5(1960). (In Russian)

At high frequencies the field produced by primary single re-radiation is prevailing, and the reactive conductivity tensor becomes $i\omega\delta_{ik}$, when $\omega_p/\omega \ll 1$ and $\omega_H/\omega \ll 1$ (where ω_H is the cyclotron frequency). An analysis is made of the case where $\omega_p/\omega \ll 1$ and $\omega_H/\omega \ll 1$, and the secondary field has a stationary or slowly changing complex amplitude $\tau\omega/2\pi \gg 1$ (τ is the time constant of the amplitude function). The effective volume of the coherently re-emitting region is increased when the maximum concentration is distributed in the layer with a curvature corresponding to the condition $r_r + r_t = \text{const}$. With complex distribution n, the volume with an integrated stationary phase acts as the determining factor. (R.V.J.)

22484

SECONDARY REACTIONS IN A GAS DISCHARGE. Irene B. Ortenburger (Lockheed Missiles and Space Div., Palo Alto, Calif.) Martin Hertzberg, and Richard A. Ogg, Jr. J. Chem. Phys. 33, 579-83(1960) Aug.

The pressure variations of H^+, H_2^+, H_3^+, He^+, and HeH^+ ions emanating from an electrodeless discharge in pure hydrogen and in mixtures of hydrogen and helium were measured. Mass analysis was accomplished with a strong-focusing mass spectrometer. The analysis of the results in hydrogen are discussed, as well as the alternative mechanisms for hydrogen dissociation. From the results in hydrogen-helium mixtures, a value of 0.37 ± 0.15 was obtained for the ratio k_3'/k_1', where k_3' is the rate constant for reaction $He^+ + H_2 \rightarrow HeH^+ + H$ and k_1' is the rate constant for the reaction $H_2^+ + H_2 \rightarrow H_3^+ + H$. In addition, a value of 0.016 ± 0.013 was obtained for the ratio k_3'/k_2', where k_3' is the rate constant for the reaction $H_2^+ + He \rightarrow HeH^+ + H$. (auth)

22485

INTRODUCTION TO THE PROBLEM OF CONTROLLED NUCLEAR FUSION. Walter Köppendörfer (Technische Hochschule, Munich). Kerntechnik 2, 217-22(1960) July-Aug. (In German)

The theoretical hypotheses of thermonuclear fusion of light elements and the experimental attempts to realize it are described. It is shown that a gas (deuterium is the best) must be heated to a temperature of about 100 million degrees to obtain stationary fusion. The only media to contain so hot a gas are magnetic fields. The simplest and most important experimental devices in which it is sought to contain and heat a plasma are described. These are the pinch discharge, the Stellarator, and the Scylla. (tr-auth)

22486

A THERMODYNAMIC CALCULATION AND THE PRODUCTION OF VERY HIGH TEMPERATURES. M. Pierucci (Universita Modena, Italy). Met. ital. 52, 273-6(1960) June. (In Italian)

With the method already described at the VII Colloquium Spectroscopicum Internationale of Liège (an alternating-current-electric-arc in a constant magnetic field, or a direct-current-electric-arc into an alternating magnetic field) the hypercontracted column of the electric-arc, particularly when the disruptive discharge of a powerful condenser is sent into it was studied, and from these experiments new spectroscopic considerations and new indications on the problem of the production of very high temperatures are deduced. A thermodynamic calculation is given in which (according to the fact that on the basis of precedent experience, the gaseous part of the arc can be considered as a closed space) the whole of very numerous electrons, introduced into the arc from the strong condenser discharge, is treated as an electronic gas, in thermodynamic equilibrium with the gas of atoms, ions and photons of the arc. On the basis of these calculations a temperature of 10^{6}°K is estimated for the hypercontracted column in the case of a powerful condenser disruptive discharge in the arc. (auth)

22487

DIAMAGNETIC MOMENT OF GASEOUS PLASMAS MEASURED BY SPIN RESONANCE TECHNIQUES. T. C. Marshall, R. A. Kawcyn, and L. Goldstein (Univ. of Illinois, Urbana). Nature 187, 584-5(1960) Aug. 13.

Typical measurements are reported for the diamagnetic moment of plasmas in static magnetic fields, using resonance techniques for field shift detection. For measuring the moment in low fields, electron spin resonance in diphenylpicrylhydrazyl was used with a mercury plasma; the results indicate a maximum moment at field strengths near 50 gauss. For high fields, proton resonance was used to measure the moment in a Ne-1 % Ar plasma; the moment was observed to decrease exponentially with the field. Full details of the measuring techniques and possible applications are given. (D.L.C.)

22488

DIFFUSION PROCESSES IN A PLASMA COLUMN IN A LONGITUDINAL MAGNETIC FIELD. F. C. Hoh and B. Lehnert (Royal Inst. of Tech., Stockholm). Phys. Fluids 3, 600-7(1960) July-Aug.

Earlier results, by Lehnert, on the diffusion processes in the positive column in a longitudinal magnetic field were confirmed in a new series of measurements over a wide range of data. Experiments with helium, argon, krypton, nitrogen, and hydrogen are described. In the case of helium good agreement is obtained between the collision diffusion theory and the experiment up to a certain critical magnetic field. For stronger fields the potential drop along the column indicates a much higher diffusion rate across the magnetic field than that expected from the binary collision theory. Account is taken, in the theory, of the presence of molecular ions and of charge exchange collisions. Abnormal voltage characteristics indicating an increased diffusion rate above a certain magnetic field strength have also been investigated in argon, krypton, nitrogen, and hydrogen. The transition from the normal to the abnormal branch of the characteristics seems to depend neither on the length of the discharge tube nor on the length of the magnetic field, provided that these lengths exceed some fifty tube diameters. On the other hand, the transition depends upon the gas density, the nature of the gas, the tube radius, and,

also slightly, upon the discharge current. The transition is also indicated by an increasing noise level above the transition point. Finally, the product of the magnetic field strength and the tube radius seems to be constant at this point. (auth)

22489

PLASMA VISCOSITY IN A MAGNETIC FIELD. Allan N. Kaufman (Univ. of California, Livermore). Phys. Fluids 3, 610-16(1960) July-Aug.

The viscosity of a fully ionized plasma in a magnetic field is analyzed from two points of view: first, from a consideration of particle orbits; and second, from the solution of a simplified Boltzmann equation. These semi-quantitative methods are studied in order to clarify the behavior of the viscosity coefficients. (auth)

22490

EXPERIMENTS ON PLASMOID MOTION ALONG MAGNETIC FIELDS. David M. Wetstone, Melvin P. Ehrlich (New York Univ., New York), and David Finkelstein. Phys. Fluids 3, 617-30(1960) July-Aug.

Time-integrated photographs are presented of collimated plasmoid motion parallel to magnetic fields, into and around magnetic flux diverters, into and out of magnetic mirrors, and along curved fields. Field strengths up to 3 weber/m^2 were employed. The material projected along the field lines was substantially copper plasma, created by short vacuum spark bursts (plasmoids), and injected into a vacuum chamber. Flux diverters and nonuniform solenoids expanded or compressed the plasmoid, which followed the field lines. In the case of curved fields, at least parts of the plasmoid appeared to be guided by the field lines, the guidance improving with decrease in plasmoid density. In general the behavior was more complicated than with straight geometries because of the presence of internal polarization fields. Photomultiplier studies were employed with some geometries to estimate center of mass and expansion velocities which, in later experiments, reached 5.5 and 1.9 cm/μsec. The latter figure gives an upper bound to ion temperature of 120 ev for copper. This ion energy is considerably higher than those normally encountered in spark channels and is a substantial fraction (0.12) of the axial energy. A mechanism is described for achieving such a thermal energy through the interaction of a strong shock wave with the initial discharge channel, thermalizing a large fraction of the axial energy. The upper bound for ion Larmor radius was that of the plasmoid. In order to extend the well-known treatment of the mirror reflection phenomenon to such a dynamical plasma, a theoretical total reflection coefficient is derived for a plasmoid entering a magnetic mirror. The experimental equipment is described, and a machine-computational method is outlined for mapping the flux distribution and density in a wide variety of solenoid geometries and combinations. (auth)

22491

OBSERVATION OF ION CYCLOTRON WAVES. Thomas H. Stix and Richard W. Palladino (Princeton Univ., N. J.). Phys. Fluids 3, 641-7(1960) July-Aug.

The existence of ion cyclotron waves was inferred from theoretical calculations and indirectly from experimental observations. Direct experimental observations are reported of phenomena appropriate to these waves in a hot plasma. An induction coil energized at 11.5 Mc with approximately 200,000 w of rf power surrounds a deuterium plasma confined in a 16-kilogauss magnetic field. A single-turn rf magnetic probe located in the plasma about 50 cm down the axis from the center of the induction coil is used to detect the propagated wave. The probe is movable. Radial motion of the probe shows the expected penetration of the transverse rf field into the center of the plasma. Axial motion of the probe shows a 300-cm damping length, and an oscillation wavelength 64% longer than the calculated value. The probe signals disappear when the ion cyclotron frequency is less than the induction coil frequency, which is a result predicted from the ion cyclotron wave dispersion relation. (auth)

22492

HYDROMAGNETIC STABILITY OF FORCE-FREE TOROIDAL FIELDS. John L. Johnson (Princeton Univ., N. J.). Phys. Fluids 3, 658-9(1960) July-Aug.

Stellerators can be made hydromagnetically stable during the ohmic heating phase of their operation when the pressure is zero. It was shown that for force-free systems curvature does not affect the stability criteria which were obtained for a large class of equilibria in which small multipolar fields and axial currents distort a zero-pressure plasma in a uniform axial field. (M.C.G.)

22493

STUDIES OF PLASMA HEATED IN A FAST-RISING AXIAL MAGNETIC FIELD (SCYLLA). K. Boyer, W. C. Elmore, E. M. Little, W. E. Quinn, and J. L. Tuck (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 119, 831-43(1960) Aug. 1.

The Scylla plasma experiment, which employs a rapidly rising magnetic field in a cylindrical mirror geometry to produce and heat a deuterium plasma, is described. Experimental studies of the reproducible neutron emission from the hot plasma show that the neutrons are emitted (1) in a symmetrical, bell-shaped time distribution centered on the maximum of the magnetic field, (2) from a limited region with a 2 cm axial length and a 1.5 cm diameter centered in the compression coil, and (3) in the radial direction with a narrow spread of energies and no significant anisotropy. The time distribution of the neutron emission is shown to be in agreement with a thermonuclear yield curve calculated for an adiabatic compression by the observed magnetic field. The neutron yield was studied as a function of deuterium pressure, capacitor-bank voltage, and nitrogen impurity. Observations of the space-time distribution of the visible light emission with a streak camera show that a strong radial "shock" occurs at the beginning of the second half-cycle, very little light is emitted from the plasma "fireball" during the time of neutron emission, and an intense luminous flux is produced during the later stages of the discharge. The energy absorbed in each half-cycle of the discharge by the gas is presented as calculated from the incremental damping of the driving magnetic field. Observations of hard x-ray emission (~200 kev) at times of maximum dB/dt for operating pressures in the 5 to 50 micron range are contrasted with the characteristics of the neutron emission in regard to time distribution, pressure, impurities, and rf pre-excitation. Magnetic probe studies of the Scylla discharge are reported and evidence is given that the perturbing effects of the probe dominate the plasma temperature. (auth)

22494

CONTINUUM RADIATION IN THE X RAY AND VISIBLE REGIONS FROM A MAGNETICALLY COMPRESSED PLASMA (SCYLLA). F. C. Jahoda, E. M. Little, W. E. Quinn, G. A. Sawyer, and T. F. Stratton (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 119, 843-56(1960) Aug. 1.

The identification of a sharp low-wavelength cutoff in

the spectrum of x rays emitted from deuterium discharges in Scylla resulted in the assignment of an electron temperature of 240 ± 40 ev at the time of peak magnetic field compression. Simultaneous time-resolved absolute intensity determinations in the visible continuum, when coupled with the temperature measurement, yield an upper limit electron number density of $(5 \pm 1) \times 10^{16}/cm^3$ at peak compression. The absolute value of $dE/d\lambda$ in the soft x ray region is two hundred times larger than bremsstrahlung from a pure deuterium plasma at the temperature and density quoted, and it is postulated that the large experimental $dE/d\lambda$ is the result of recombination radiation from about 2% of oxygen contaminant from the discharge tube walls. (auth)

22495

VELOCITY SPECTRUM OF PROTONS AND TRITONS FROM THE d-d REACTION IN SCYLLA. D. E. Nagle, W. E. Quinn, F. L. Ribe, and W. B. Riesenfeld (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 119, 857-62(1960) Aug. 1.

A diagnostic experiment was carried out on the d-d reactions produced by fast magnetic compression of a deuterium plasma. A determination of the velocity spectra of protons and of tritons from the d-d reaction was made by magnetic analysis and nuclear plate detection of the particles. The observed distributions were Gaussian, with widths which corresponded to a deuteron temperature of 1.3 kev. Comparison of the mean proton and triton momenta indicated that no plasma drift in the (axial) direction of observation was present, nor any potential difference between the source plasma and detector greater than a few volts. These results, coupled with previous ones on the neutron yield, duration, source extent, and lack of circumferential drift argue against any of the simple, physically plausible non-Maxwellian acceleration mechanisms for the d-d reactions so far proposed. (auth)

22496

ELECTRICAL AND THERMAL CURRENTS IN A SLIGHTLY IONIZED GAS. Mahendra Singh Sodha (Armour Research Foundation, Chicago). Phys. Rev. 119, 882-6(1960) Aug. 1.

The Boltzmann equation was solved for electrons in a slightly ionized gas under the influence of an electric field (ac + dc), a magnetic field, and temperature gradient. Expressions for the electrical and thermal currents were obtained in terms of integrals having collision frequency and f_0, the isotropic part of the distribution function, in the integrand. A differential equation for f_0 was set up and analytical expressions obtained under simplifying assumptions. The application of the analysis to transport properties and electromagnetic wave propagation was indicated. (auth)

22497

ON THE THEORY OF RAREFIED GAS DEIONIZATION IN A MAGNETIC FIELD. A. S. Syrgiĭ and V. L. Granovskiĭ (Lomonosov Moscow State Univ.). Radiotekh. i Elektron. 5, 1129-34(1960) July. (In Russian)

The theory of rarefield gas deionization is developed for a cylindrical container placed in a uniform magnetic field parallel to the axis. The residual plasma is assumed to be isothermal, and diffusion and volume recombinations of charged particles are considered. The derived formulas are developed using helium at 0.06 to 0.33 mm mercury and a magnetic field of 0 to 1500 gauss. (R.V.J.)

22498

THE INVESTIGATION OF A HIGH FREQUENCY PLASMA WITH A DIRECT CURRENT PROBE. Hans Fetz and Hans Oechsner (Universität, Würzburg, Ger.). Z. angew. Phys. 12, 250-3(1960) June. (In German)

After some remarks on the carrying out of probe measurements in high-frequency plasma by the Langmuir method, a new probe method, with which the characteristic data of the plasma of a high-frequency discharge can be determined, was presented. The positive pole of a constant voltage source is connected to a probe whose surface immersed in the plasma could be varied. At the negative pole of this voltage source is the ion-extracting surface-constant counter electrode. One needs an additional reference electrode which is at a steady potential and is in contact with the probe circuit, composed of the probe, voltage source, and opposing electrode, only across a high resistance voltmeter. The current in the probe circuit and the potential difference which arises between probe and electrode were measured as a function of the variable probe surface. From both the curves determined, the plasma data sought were obtained. From the pattern of the current in dependence on the probe surface, it can be directly determined at which size of the probe it is at plasma potential. (tr-auth)

22499

THE EFFECT OF THE LANGMUIR LAYER BETWEEN PLASMA AND APPARATUS WALL ON THE WAVE BROADENING IN A PLASMA COLUMN. Winfried Otto Schumann (Technische Hochschule, Munich). Z. angew. Phys. 12, 298-300(1960) July. (In German)

For illustration of the more precise variation of the plasma velocity of an electric wave with the frequency in a plasma column, the effect of the glass tube in which the discharge occurs and the effect of the Langmuir layer between plasma and glass tube were considered in the calculation of the wave broadening. (tr-auth)

22500

THE EFFECT OF THE PERIODICITY OF THE PULSE IN CORONA DISCHARGE ON THE HIGH FREQUENCY SPECTRUM. Werner Heintz (Physikalisch-Technische Bundesanstalt, Brunswick.). Z. angew. Phys. 12, 320-2(1960) July. (In German)

The pulse frequency of the Trichel pulse occurring in the negative corona discharge fluctuates according to a Gaussian distribution about a mean value. This leads to the appearance of a continuous and superimposed discrete high-frequency spectrum whose constituents vary according to the operating magnitudes. A relation formulated for this pulse modulation accurately represents the spectrum of the discharge current as a function of the frequency. (tr-auth)

22501

NEGATIVE ELECTRICAL CONDUCTIVITY. Jürgen Schneider (Institut für Elektrowerkstoffe, Freiburg i. B.). Z. Naturforsch. 15a, 484-9(1960) May-June. (In German)

The complex electric h-f conductivity σ of a plasma in a magnetic field was calculated on the basis of the Boltzmann transport equation. Negative values of the real part of σ can occur, if the system is in a state of overpopulation, i.e., if $\partial f_0/dp > 0$, where f_0 is the momentum distribution function of the free carriers. Furthermore, the collision frequency or the mass of the carriers must be dependent on the momentum p. (auth)

22502

WEAK DISCONTINUITIES IN MAGNETOHYDRODYNAMICS. J. Szabó (Universität, Budapest). Z. Naturforsch. 15a, 503-5(1960) May-June. (In German)

It was shown that a weak discontinuity in an ideal plasma is propagated with the velocity of small perturbations. It was also indicated that the advancing surface of weak dis-

continuities and the characteristics of the equation system of the magnetohydrodynamics of ideal media are one and the same. (tr-auth)

22503

THE ENERGY EMISSION OF A MODULATED ION BEAM IN A PLASMA WITH MAGNETIC FIELD. R. Kippenhahn and H. L. de Vries (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. 15a, 506-12(1960) May-June. (In German)

A beam of ions penetrating a plasma perpendicular to a homogeneous magnetic field is investigated. The particle density of the beam may be modulated by varying the intensity of the ion source with the frequency ω. For simplicity, the ions are assumed to move with equal velocity w. The modulation of the beam produces oscillations of the plasma and the ions of the beam will loose energy; therefore it should be possible to trap the injected particles in the plasma. Furthermore, the kinetic energy of the trapped particles will be transformed into thermal energy of the plasma. The ion source is assumed to deliver a linear beam (of sufficiently small diameter). Upon being shot into a plasma with a magnetic field, the ions will travel along a curved line. In order to treat the problem exactly, one would have to solve simultaneously the equations of motion for the plasma coupled with those for the individual ions of the beam. The problem is simplified in that the equation of motion of the ions in the beam is not solved. Instead, it is imagined that they are forced to travel in a straight beam. The problem becomes especially simple if it is assumed that the ion source is a slit instead of a point source. Then the ions do not all travel along the same straight line, but in parallel straight lines in the plasma. The direction of motion is always perpendicular to the magnetic field. Then one may distinguish two cases of the relation of the field direction to the direction of the plane: (1) the field lines are parallel to the plane of the beam and (2) the field lines are normal to the plane. If the modulating frequency of the beam is small compared to the gyrofrequency of the electrons and compared to the plasma frequency, if the conductivity is infinite, and if the gas pressure in the plasma may be neglected, one obtains for the mean relative energy loss of an ion per cm of path, in the parallel case $2\pi r_i(N_2^2/N_1)(1/P)[(Q+P-1)/(P-1)^{1/2}]$, $(P>1)$. (N_1 number of particles per cm^2 of beam surface of the unmodulated part of the beam, N_2 the number of ions per cm^2 of the modulated part, r_i the classical ion radius, P the square of the ratio of ion velocity to Alfvén velocity, Q the aquare of the ratio of the modulating frequency to the ion gyro-frequency.) In case of P equal to one, the energy loss of the beam is infinite. For $P<1$ the energy loss will vanish identically. In the normal case the energy loss of each particle is in general of the same order of magnitude, and vanishes identically when $P<1$ and ω is greater than the gyrofrequency of the ions. If the ions move with the Alfvén velocity, one has a resonance with an infinitely great loss of energy by radiation. In reality of course there will be damping because of the finite conductivity. Assuming $N_1 = N_2 = 10^7$ particles (per cm^2 of the beam), the formula mentioned above in case of $Q + P-1/P(P-1)^{1/2} \approx 1$ will give a relative loss of energy per cm path of about 10^{-6}, which means that a particle has to travel about 6 miles in order to suffer an energy loss of about 1%. This disappointingly small loss leads us to the conclusion that only in cases of resonance measurable effects can be expected. It is certain that the energy loss in the case of the resonance $P = 1$ will exceed the value estimated above by several powers of ten. A detailed discussion of this resonance has to take into account finite conductivity of the plasma. (auth)

22504

ROTATIONAL MAGNETO-MECHANICAL EFFECT IN LOW-PRESSURE PLASMA. V. L. Granovskiĭ and E. I. Vrazakov (Moscow State Univ.). Zhur. Eksptl'. i Teoret Fiz. 38, 1354-5(1960) Apr. (In Russian)

A thin solid plate was introduced into a plasma in order to observe the rotation around the positive column axis induced by a longitudinal, uniform magnetic field. The experiments were conducted in argon and neon at 100 to 500 μ Hg. (R.V.J.)

22505

IMPROVEMENTS IN OR RELATING TO GAS DISCHARGE APPARATUS. Rendel Sebastian Pease (to United Kingdom Atomic Energy Authority). British Patent 838,117. June 22, 1960.

The design of a gas discharge apparatus of the kind in which a high-current gaseous ring discharge is established in a torus is reported. The apparatus consists of a torus on which a winding is wound in groups of one or more turns. A magnetic field is set up in an annular zone adjacent to wall of the torus and contact between the discharge and the wall is resisted by the repulsive effect of the field on the highly conductive skin layer of the discharge. (W.L.H.)

22506

THERMONUCLEAR REACTOR. (to United States Atomic Energy Commission). British Patent 841,792. July 20, 1960.

A method and means for establishing a controlled thermonuclear reaction are reported. The reactor consists of a pinch device for establishing an annular high-intensity plasma and a magnetic field for deflecting plasma particles to produce an orbital particle path in the plasma. (W.L.H.)

22507

DEVICE AND METHOD FOR PRODUCING AND MAINTAINING VERY HIGH TEMPERATURES, SUFFICIENT TO REALIZE CONTROLLED NUCLEAR REACTIONS. (to Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V.). French Patent 1,185,102. Feb. 9, 1959.

A high-temperature plasma (at more than 10^7°K) is confined in an annular vessel by means of nonhomogeneous magnetic fields parallel to the axis of the vessel. An electric current is generated in the plasma parallel to the axis of the vessel. The plasma can be heated by ohmic heating, stimulation of resonant vibrations electromagnetic fields, adiabatic compression, injection of neutral particles of high velocity, or gyromagnetic relaxation.

22508

IMPROVEMENTS TO THERMONUCLEAR REACTORS. (to Metropolitan-Vickers Electrical Co., Ltd.). French Patent 1,186,342. Feb. 23, 1959.

A strong magnetic field is applied parallel to the axis of a rotationally symmetrical evacuated vessel. Electrons are projected toward the center of the vessel along the axis, ions of light elements to the same point in a plane perpendicular to the axis. The heat developed by thermonuclear reactions is carried off by a cooling agent flowing through a thermal screen which may be arranged so as also to protect the current windings producing the magnetic field.

22509

IMPROVEMENTS IN THE PERFORMING OF NUCLEAR REACTIONS. Th. Volochine. French Patent 1,192,142. Apr. 20, 1959.

It is suggested to perform nuclear fusion reactions by the interaction of two beams of magnetically polarized particles, such as neutrons, protons, or deuterons. Both kinds of particles are polarized in such a manner that their

spins are orientated in the same or in the opposite direction; dependent on this the particles are brought together in a direction perpendicular or parallel to the direction of their spins and magnetic moments. It is stated that the polarization provokes an attraction between the particles which increases the chance of fusion; a vectorial presentation is given to support this theory as well as a schematic device in which the fusion reactions can be performed.

22510

DEVICE FOR EFFECTING THERMONUCLEAR REACTIONS. (to United Kingdom Atomic Energy Authority). French Patent 1,197,962. June 8, 1959.

A discharge of more than 100 ka is induced in a toroidal vessel containing deuterium or a mixture of deuterium and tritium at low pressure. This can be achieved by two impulse transformers situated at opposite ends of a diameter of the vessel. The metal wall of the vessel is interrupted at each of two places by a ring-shaped insulating insertion; in the vicinity of each such place the torus is provided internally with a "protecting" metal cylindrical sector. In addition there may be other such sectors in the rest of the torus, mutually insulated. Between any adjacent pair of sectors a high-frequency voltage can be applied to facilitate the ionization of the gas. In order to stabilize the gaseous discharge, the walls of the vessel are made thick and current windings produce a constant magnetic field parallel to the circular axis of the vessel.

Shielding

22511 NDA-2056-6

Nuclear Development Corp. of America, White Plains, N. Y.

THE TRANSMISSION OF GAMMA RAYS AT SLANT INCIDENCE THROUGH SLABS OF VARIOUS MATERIALS IN SHIELDING. L. Pullman. Oct. 10, 1956. Decl. Mar. 31, 1960. 109p. For General Electric Co. Aircraft Nuclear Propulsion Dept. Subcontract AT-29. OTS.

Compilations of and analytical indexes to graphs and tables of γ ray slant penetration data and graphical comparisons between attenuations computed from Reactor Handbook γ ray slant penetration parameters, and selected attenuation data reported elsewhere are presented. (W.L.H.)

22512

EXPERIMENTAL STUDIES ON SHIELDING MATERIALS AGAINST IONIZING RADIATIONS. Ken'ichi Hashimoto, Toshio Kuroshawa, and Motoshi Kaneko. Repts. Gov. Chem. Ind. Research Inst. Tokyo 55, 155-64(1960) May. (In Japanese)

The measurements were made on several samples of concrete made of portland or aluminous cement containing magnetite or barite as heavy aggregate for shielding γ rays, and those containing boron compound or hydrous aggregate for absorbing neutrons. The attenuation coefficient for Co^{60} γ rays was measured by a γ-ray spectrometer and the absorption coefficient was calculated. By the measurement of count as well as γ dose build-up, it was found that barite is better than magnetite as an aggregate. The oblique attenuation of γ rays was measured by a Geiger-Mueller counter, and it was confirmed that its build-up is usually larger than that of perpendicular incidence, but the crossover between the two may occur within a relaxation length. "Krillium" was tested to prevent the heavy aggregates from sinking in course of the setting of cement, and its effectiveness was recognized. (auth)

Theoretical Physics

22513

WAVE EQUATIONS INVARIANT UNDER DISCONTINUOUS GROUPS AND THE PROBLEM OF NUCLEAR FORCES. P. G. Oliver Freund (Facultatea de Matematica si Fizica, Timisoara, Rumania). Acta Phys. Polon. 19, 139-48(1960). (In English)

It is shown that physical space has only the role of a representation-space of a certain group. In a consequently discontinuous theory, space-time, therefore, may be left topological but the fundamental group is to be taken discontinuous. A 2-dimensional theory of nuclear forces invariant only under a discontinuous rotation group is developed. Hence an angular periodicity of the nuclear forces results. 3- and 4-dimensional generalizations lead to the non-euclidianity of space and space-time and thus may serve as physical supports to Einstein's gravitation theory. It is shown that theories invariant under discontinuous groups do not contain conservation laws. (auth)

22514

THE BASIC EQUATIONS OF NON-RELATIVISTIC WAVE MECHANICS. Andre Rot (Institut Henri Poincaré, Paris). Ann. inst. Henri Poincaré 16, 235-87(1960). (In French)

The Schroedinger wave equation is examined to determine if it can be formulated in a more rigorous and at the same time more general form to synthesize the ideas of wave and corpuscular motions. The various possibilities which are contained in non-relativistic wave mechanics and which seem to be the prerogative of relativistic theories are examined. The cases of spin and isotopic space are considered. (J.S.R.)

22515

THE THEORY OF PARTICLE SYSTEMS IN THE CAUSAL INTERPRETATION OF WAVE MECHANICS. João Andrade e Silva. Ann. inst. Henri Poincaré 16, 289-359 (1960). (In French)

An attempt is made to show that it is possible to construct a theory of particle systems in accord with the basic ideas of the causal interpretation of wave mechanics by the theory of the double solution. After a discussion of the theory of the individual particle, the de Broglie and Vigier theories on the causal interpretation of the theory of systems are examined. It is then shown that it is possible to reframe the analytical mechanics of systems and, in particular, the Hamilton-Jacobi theory in a space with three dimensions. The question of the form of the basic equations in physical space is discussed in detail. The statistical theory of systems of particles of different nature is explained. (J.S.R.)

22516

NOTE ON SCATTERING THEORY. Mauro di Fazio (Laboratoire de Recherches Nucléaires, Institut de Physique, Geneva). Arch. sci. (Geneva) 12, 682-6(1959) Oct.-Dec. (In French)

Remarks are made concerning scattering theory in a multiple process. This is the case of a scattered particle which can still react with the reaction products. (T.R.H.)

22517

A NEW FORMULA OF THE THEORY OF FUSION. G. A. Sokolik (Lab. of Magnetism, Academy of Sciences, USSR). Nauch. Doklady Vysshei Shkoly, Fiz.-Mat. Nauki No. 1, 165-7(1959). (In Russian)

A new mathematical interpretation of de Broglie's fusion theory is presented, being of special interest in connection with current efforts aimed at the reduction of all fields to the fundamental spinor field. This is related to previous

attempts of other authors to obtain the reaction algebra of elementary particles by means of a compound particle. (TTT)

22518

COMMUTATION RELATIONS OF QUANTUM MECHANICS. Joseph V. Lepore (Univ. of California, Berkeley). Phys. Rev. 119, 821-6(1960) July 15.

The mathematical and physical meaning of the commutation relations of nonrelativistic quantum mechanics is discussed in terms of the representation of translations, Galilean transformations, and rotations of the coordinate system by unitary transformations acting on the unitary vector space of quantum states. (auth)

22519

UNSTABLE PARTICLES IN A GENERAL FIELD THEORY. J. Gunson and J. G. Taylor (Univ. of Cambridge, Eng.). Phys. Rev. 119, 1121-5(1960) Aug. 1.

The problem of unstable particles in quantum field theory is treated as one of the interpretation of complex singularities appearing in the analytic continuation of scattering amplitudes into unphysical sheets of their Lorentz invariant variables. Suitable continuations are shown to hold under certain restrictive assumptions in a general field theory, making use of unitarity and causality of the S matrix. The extra singularities appearing in the continuation are fixed isolated poles, in accordance with a conjecture of Peierls. (auth)

22520

REMARKS ON THE CANONICAL ENERGY PSEUDO TENSORS OF THE GENERAL COVARIANT WAVE FIELD THEORIES. Géza Knapecz. Z. Naturforsch. 15a, 467-70 (1960) May-June. (In German)

With the aid of universally valid arguments, it was shown that one can explain the strong and weak canonical energy pseudotensor of a random general covariant wave field independently of its poor transformation characteristics and not as the representation of the energy. (tr-auth)

REACTOR TECHNOLOGY

General and Miscellaneous

22521 AAEC/E-44

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.

SOME ASPECTS OF THERMAL NEUTRON DIFFUSION IN NON-UNIFORM TEMPERATURE MODERATORS. J. J. Thompson. July 1959. 11p.

The effect of non-uniform temperature on the Maxwellian distribution of thermal neutrons in a non-capturing moderator was studied, using the heavy gaseous moderator approach. The results indicate that for typical temperature gradients in power reactors, the neutron temperature follows the moderator temperature with negligible distortion of the spectrum, and that at the boundary between regions of different temperature, perturbations are restricted to a few centimeters. (auth)

22522 AHSB-41

United Kingdom Atomic Energy Authority. Authority Health and Safety Branch, Risley, Lancs, England.

GUIDE TO SAFETY REPORT REQUIREMENTS. I. STAGE 1 GAS-COOLED GRAPHITE-MODERATED REACTORS. J. F. Ablitt. Apr. 22, 1960. 27p.

This report supersedes Report No. IGS-R/R-9.

This Guide was prepared in order to assist those responsible for preparing and submitting Safety Reports for Stage I reactors in connection with the provision of the Nuclear Installations (Licensing and Insurance) Act of 1959. The purpose of a Reactor Safety Report is discussed, stressing in particular the need for a consistent demonstration throughout, of the ways in which stated Safety Principles are implemented in the design, construction, and operation of the reactor. The recommended stages for Safety Report submissions are described, and the minimum detailed information requirements for both Intermediate and Final Safety Reports are specified, convenient methods of presentation being suggested. The information required is that which was found by experience to be necessary to enable a thorough Safety Assessment to be carried out. Compliance with the suggested form and content will greatly facilitate the work of those responsible for assessment. (auth)

22523 APAE-Memo-72

Alco Products, Inc., Schenectady, N. Y.

AIR SCATTERING CALCULATIONS FOR REMOTE SITE EARTH SHIELD. S. S. Rosen. Dec. 11, 1956. 8p. Contract DA-44-009-Eng-2864.

In the design of an earth shield for a remote site APPR, where vapor containment would not be necessary, it would be very desirable if a shielded roof did not have to be put over the system. Air scattering calculations are presented which show that a shielded roof is not necessary, thereby eliminating many problems that such a structure would bring about. (W.D.M.)

22524 CF-58-10-55

Oak Ridge National Lab., Tenn.

ORNL-20 MTR IN-PILE LOOP INSTRUMENTATION. R. G. Affel. Oct. 24, 1958. 53p. Contract [W-7405-eng-26]. OTS.

The design philosophy, control actions, and functional operation of the instrumentation and control associated with the ORNL-20 in-pile experiment operated in the MTR in 1955-6 are briefly described. (auth)

22525 CF-59-10-7

Oak Ridge National Lab., Tenn.

FEASIBILITY STUDY—USE OF SMALL-DIAMETER WIRES IN UO_2 PELLETS FOR IN-PILE TEMPERATURE MONITORING. R. E. Meadows and W. C. Thurber. Oct. 23, 1959. 55p. Contract [W-7405-eng-26]. OTS.

The feasibility of using small-diameter wires strategically placed at various radial locations in UO_2 pellets for measurement of temperatures in in-pile experiments was studied. Evidence of melting of the wires as revealed by post-irradiation metallographic inspection was selected as the specific method of temperature determination. To select wires best suited for this application, the compatibility of gold, copper, nickel, iron, platinum, vanadium, and niobium with UO_2 was studied. On the basis of short-term compatibility tests, gold, copper, and iron were found to be compatible with UO_2 to temperatures slightly above their respective melting points. Nickel, platinum, and vanadium reacted with UO_2 below their melting points. Niobium did not react with UO_2 at temperatures to 1800°C although the compatibility of this material with UO_2 at higher temperatures was not established because of equipment limitations. Since metals appeared to be generally reactive with UO_2 at very high temperatures, the use of small-diameter wires for temperature monitoring did not appear to be a promising experimental technique. (auth)

22526 CF-60-7-53

Oak Ridge National Lab., Tenn.

SHIELDING OF DEMINERALIZERS AND FILTERS IN THE

HFIR PRIMARY COOLANT SYSTEM. H. A. McLain and L. A. Haack. July 25, 1960. 12p. Contract [W-7405-eng-26]. OTS.

Thicknesses of ordinary concrete required to shield the demineralizers and filters in the HFIR primary water system were computed for normal operating conditions and for abnormal conditions such as a meltdown of the fuel within the reactor. About 4½ ft, 3¼ ft, and 4¼ ft of concrete are required to shield the cation exchange unit, the anion exchange unit, and the filter unit, respectively, to the most stringent of the following radiation levels: (a) 0.75 mr/hr for normal reactor operation or reactor operation with one defective fuel plate; (b) 1 r/hr immediately following the meltdown of 1% of the fuel; and (c) 1 r/hr 24 hours following a total fuel meltdown. Shielding thicknesses may be estimated for other tolerances from the graphs presented. (auth)

22527 CRL-60

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

AN INTRODUCTION TO REACTOR PHYSICS. R. G. Jarvis. May 1960. 139p. (AECL-1033). AECL.

Some of the lectures on reactor physics given in the Deep River Extension School during 1957 to 1959 are presented. A familiarity with basic nuclear physics is assumed. Topics covered include neutron diffusion, the conservation of neutrons, one-group theory in homogeneous systems, slowing-down and two-group theory, heterogeneous reactors, kinetic behavior, perturbation theory, and fission product poisons. (W.D.M.)

22528 KAPL-M-DBM-2

Knolls Atomic Power Lab., Schenectady, N. Y.

THE CONSTANT-PERIOD APPROXIMATION FOR NUMERICAL SOLUTION OF THE SPACE-INDEPENDENT REACTOR KINETICS EQUATIONS. D. B. MacMillan. July 20, 1960. 8p. Contract W-31-109-eng-52. OTS.

An approximation is presented for use in numerical solution of the space-independent reactor kinetics equations. This "constant period" approximation is much more accurate than the usual $d\phi/dt = 0$ approximation, but retains the computing-speed advantages of the latter. Application of the "constant period" approximation is discussed. (auth)

22529 KAPL-M-ECH-5

Knolls Atomic Power Lab., Schenectady, N. Y.

DETERMINATION OF THE INTRINSIC NEUTRON SOURCE STRENGTH IN THE FPR CRITICAL ASSEMBLY. E. C. Hansen and H. F. Schulz. May 17, 1960. 25p. Contract W-31-109-Eng-52. OTS.

Analysis of experiments to measure the intrinsic neutron source strength in the FPR critical assembly at KAPL indicated that the intrinsic neutron source strength was: 36.5 ± 2.3 n/sec kg of fuel. This was in serious disagreement with both the experimental results reported by Bettis and the theoretically predicted value expected in U-metal fueled systems. The discrepancy between the presented value, 36.5 n/sec kg, and the expected value, 2–4 n/sec kg, was attributed to the strong source of neutrons from the (α,n) reaction in fluorine contained in the Teflon coating of the U-metal fuel strips. (auth)

22530 NAA-SR-Memo-244

North American Aviation, Inc., Downey, Calif.

INTRA-CELL NEUTRON DENSITIES—PART II. 3/4 INCH, 1 INCH, 1-1/4 INCH, 1-1/2 INCH AND 2 INCH DIAMETER NATURAL URANIUM RODS. D. Woods, E. Cohen, and A. T. Biehl. Mar. 7, 1952. Decl. June 13, 1960. 106p. OTS.

Results are presented of measurements of intra cell neutron flux distributions in natural uranium-D_2O lattices as the rod size and cell spacing is varied. Interpretation of the results indicated the following: (1) diffusion theory is a poor approximation for the flux distribution inside the rods as well as in the D_2O moderator, and (2) the effective neutron temperature increase is predominantly due to selective absorption in the uranium rods. Approximate expressions using an extrapolation length are given for calculating flux distributions. This method yields numerical values closer to experimental values than simple diffusion theory. (auth)

22531 NARF-60-23T

Convair, Fort Worth, Tex.

SPECIFICATION OF NEUTRON FLUX IN THE CONVAIR RADIATION EFFECTS TESTING FACILITY. W. E. Dungan. June 30, 1960. 116p. Contract AF33(600)-38946. (MR-N-270).

The current state-of-the-art in the specification of the neutron flux in the Convair Radiation Effects Testing Facility is described as it relates to activation and radiation damage in materials. The results are adaptable to configurations in which a boral-shielding material is used. These results indicate that the neutron flux in the facility may be reasonably specified by a series of integrals of an isotropically attenuated, analytical spectrum. This spectrum is normalized to experimental thermal- and fast-neutron measurements. Recommendations concerning foil-exposure methods are presented. Specific data concerning flux measurements and perturbations are included. (auth)

22532 WAPD-232

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

A P-9 MULTIGROUP METHOD FOR SOLUTION OF TRANSPORT EQUATION IN SLAB GEOMETRY. R. C. Gast. May 1960. 44p. Contract AT-11-1-GEN-14. OTS.

Some of the details are given of theory and practice involved in the use of RDR-5, which provides for slab geometry, a ten ordinate, multigroup solution to the transport equation, and PREP, which supplies input data for RDR-5. No attempt is made to repeat the detailed information already available. However, some parts of the theory required for a more complete understanding of the present work are presented. (auth)

22533 WAPD-TM-203

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

ABRAC— AN IBM-704 THREE DIMENSIONAL NUCLEAR-THERMAL DEPLETION PROGRAM WITH DISTRIBUTED VOID EFFECTS. W. M. Jacobi, T. J. Lawton, S. H. Meanor, and J. R. Parrette. Mar. 1960. 132p. Contract AT-11-1-GEN-14. OTS.

ABRAC is a three dimensional nuclear thermal depletion program to study the effects of water moderator density changes, resulting from flow variations and boiling, on neutron flux distribution and depletion. The program requires an IBM-704 with a memory of 32,768 words and ten tape units. (auth)

22534

SPATIAL VARIATION OF THE NEUTRON SPECTRUM IN A HETEROGENEOUS REACTOR. MODERATED AND COOLED WITH NATURAL WATER. I. Purica, A. Ştefănescu, and M. Sabău. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 323-30 (1960). (In Rumanian)

In the physical calculations of reactors with enriched uranium, cooled and moderated by natural water, and in

calculations on the production of radioisotopes, it is useful to know the energy spectrum of neutrons and the spatial variation of its characteristics. The neutron spectrum has been considered as divided into three groups: the thermal group designated by ϕ_{th} and having a Maxwellian or approximately Maxwellian distribution; the epithermal group ϕ_{ep} characterized by a B/E distribution (B being a constant); and the fast neutron group ϕ_r. The characteristic parameters of each of these groups (the neutron temperature, the constant B, their absolute determination, and their spatial variation in the active zone) are studied. Absolute measurements of the thermal, epithermal, and fast neutron flux were made on the research reactor at the Institute of Atomic Physics, and the values were compared with theoretical values from three-group calculations. Their agreement is satisfactory. The neutron temperature measured at the center of the active zone is 415 ± 27°K. (tr-auth)

22535

AUTOMATIC CONTROL OF A REACTOR AT CONSTANT POWER. J.-M. Cottier, P. Denis, and D. Roux (Laboratoire de Recherches Nucléaires, Institut de Physique, Geneva). Arch. sci. (Geneva) 12, 261-5(1959) Apr.-June. (In French)

Automatic control was studied for stabilizing the AGN 201-P reactor at constant flux for an undetermined duration after having reached the desired power with a stable period corresponding to about 3 thousand percent reactivity. The results recorded show that the precision was greater when the reactor operated at high power. Effectively, when the reactor ran at several Mw the rapid fluctuations caused by background are greater than 5% and the sensitivity should be reduced as a consequence even though the excessively fast fluctuations are damped by a tachymetric dynamo mounted in counter reaction on the galvanometer. Starting at 1 watt the maximum sensitivity can be conserved and the power is thus maintained with instantaneous precision better than 0.3%. The recorded results confirm a correction frequency varying from 30 to 120 sec. (tr-auth)

22536

STUDY OF INFINITE, UNMODERATED, HOMOGENEOUS CRITICAL REACTORS. J. J. Schmidt (Universität, Kiel). Atomkernenergie 5, 245-56(1960) July-Aug. (In German)

Within the scope of the integral equation theory for fast reactors the following study deals with the limit case of the infinite, unmoderated, critical reactor, homogeneously composed of fissionable, fertile and cooling material. The integral equation for the neutron energy spectrum of such a reactor assembly is derived and solved approximately by a matrix iteration method. The data obtained from this neutron energy spectrum and characterizing the neutron economy of the infinite reactor are compared with the corresponding values of finite fast reactors. On the basis of these data the behavior of neutrons in an unmoderated reactor is studied in the energy range between 10^{-4} and 10 Mev as a function of the cooling and fertile material fraction. In particular, the influence upon the neutron energy distribution and the relation between neutron energy spectrum and fission spectrum at high neutron energies of the (n, 2n) process in U^{238}, of inelastic neutron slowing down by U^{238}, and of elastic neutron scattering in Na is evaluated. Finally, the carrying out of the calculations on the Z 22 electronic computer is discussed and the advantages as well as disadvantages of the matrix iteration method used in comparison to the usual theory of multigroup diffusion are explained. (auth)

22537

FLOW INVERSION IN GAS-COOLED REACTORS. II. EFFECTS OF UNSYMMETRICAL HEAT PRODUCTION IN THE COOLING CHANNELS, DIFFERENT GAS THROUGHPUTS, AND COUNTERCURRENT SIPHON ACTION. H. Benzler (Deutsche Babcock & Wilcox Dampfkesselwerke A.G., Oberhausen/Rhld., Ger.). Atomkernenergie 5, 256-62(1960) July-Aug. (In German)

Enlarged heat production of a reactor cooling channel gives a higher tendency for inverse flow at partial load. In a numerical example, the point of instability rises from 3.3 to 4.8% partial load at 10% overheating of one channel. It is shown that throttling in the outer cooling channels does not change the tendency for adverse flow in an appreciable amount. Finally, the influences of thermosiphon-cooling on recirculation in the reactor core are discussed. (auth)

22538

RADIATION PROTECTION CALCULATIONS FOR REACTORS. K.-H. Lindackers (Abteilung Kernenergie und Strahlenschutz des Technische Uberwachungs-Vereins, Cologne). Atomkernenergie 5, 272-7(1960) July-Aug. (In German)

Practical shielding calculations for nuclear reactors are described. Nuclear radiation involved in reactor shielding and their sources, calculation methods and their basic theories and the nuclear data of materials, which are necessary for the calculations, are listed or referred to in the special bibliography. The calculations can be made using normal desk calculators. The calculations are formed in such a way, that they may be used as proof by the Safety Authority to license the construction of the reactor according § 7 of Atomic Energy Law from 23 December 1959. (auth)

22539

APPLICATION OF ATOMIC ENERGY FOR THE DISTILLATION OF SEA WATER. Carlos Hernández Aquije and Augusto Mellado Méndez (Junta de Control de Energía Atómica, Lima). Bol. inform. junta control energía atómica (Peru) 5, 114-19(1960) May-June. (In Spanish)

The utilization of nuclear power for the distillation of sea water is considered in its economic aspects. A pressurized water reactor combined with a flash evaporator is discussed as the reactor type. The characteristics of such a reactor are tabulated. The capital costs for the installation and operation of the reactor system for flash evaporation of sea water are given. (J.S.R.)

22540

CALCULATIONS FOR THE TEMPERATURE COEFFICIENT OF A HOMOGENEOUS REACTOR OF THE WATER BOILER TYPE. István Angeli. Magyar Tudományos Akad. Atommag Kutató Intézete (Debrecen), Közlemenyek 2, 36-48(1960). (In Hungarian)

The temperature coefficient of reactivity is deduced from the temperature dependence of quantities characteristic for the reactor. The calculation for the average cross sections pertaining to the different temperatures is contained in the appendix. (auth)

22541

ADVANCED TYPES OF REACTORS. W. Winkler (Schweizerische Gesellschaft, Würenlingen, Switzerland). Neue Tech. 2, No. 6-7, 3-6(1960) June-July. (In German)

The participation in the development of "Advanced Types of Reactors" is a necessity for Switzerland. Since such a development can only be assured by long and expensive research efforts, it is desirable that these be carried out through international cooperation. (auth)

22542

EXAMINING THE VALUE OF REACTOR-SITE ENVIRONMENTAL SURVEYS. A UNITED STATES VIEW. W. B. Harris (Health and Safety Lab., U. S. Atomic Energy Commission, New York) and A UNITED KINGDOM VIEW. H. J. Dunster (United Kingdom Atomic Energy Authority, Health and Safety Branch, Risley, Lancs, Eng.). Nucleonics 18, No. 8, 66-7(1960) Aug.

The views of the United States and the United Kingdom are expressed concerning a preoperational background-radiation survey of a reactor site. Recommended procedures are presented in the former view which should reassure the public without requiring unnecessary effort and expense. A major justification for well planned pre-accident surveys is that they increase the scientific value of an emergency survey. Both agree on the importance of analyses for specific isotopes rather than gross-activity measurements. (B.O.G.)

22543

INDIUM–GALLIUM RADIATION CONTOUR OF THE IRT NUCLEAR REACTOR. A. Kh. Breger, Yu. S. Ryabukhin, S. G. Tul'kes, and E. N. Volkev. p.55-64 of "Large Radiation Sources in Industry. Vol. 1. Conference Proceedings, Warsaw, 8-12 September 1959." Vienna, International Atomic Energy Agency, 1960. (In Russian)

An indium–gallium radiation contour of the IRT nuclear reactor was prepared and represents a powerful new source of gamma radiation. The first contour of this type (RK-1) was prepared on the IRT reactor at the Physics Institute of the Academy of Sciences of the Georgian SSR. The activation calculations for indium–gallium alloy, the structural components of RK-1 and their arrangement in the reactor tank and the hot cell, the device for feeding liquid and gaseous substances into the irradiation zone, and the conveyor for solid substances to be irradiated are given. When the IRT reactor is at a power of 2000 kw, the radiation strength of the contour is equivalent to that of a gamma emitter having an activity of 20,000 g Ra equiv. The prospects for the use of the indium-gallium radiation contour for research and semi-industrial purposes are discussed. (auth)

22544

Oak Ridge National Lab., Tenn.
NUCLEAR SAFETY. Technical Progress Review, Vol. 1, No. 4. W. B. Cottrell, ed. 1960. 99p. $0.55(GPO) (domestic), $0.70(GPO) (foreign).

Coverage of the Review is limited to topics relevant to the analysis and control of hazards associated with nuclear reactors, operations involving fissile materials, and the products of fission. Primary emphasis is on safety in reactor design, construction, and operation. Reviews of current literature, special review articles on specific topics, and comparative studies of various aspects of US power reactors are presented. (W.D.M.)

22545

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Keith James Mitchell and Ian Alexander Butler Gaunt (to General Electric Co., Ltd.). British Patent 837,608. June 15, 1960.

A means of support was invented for the core (containing moderator units) of a gas-cooled reactor; it is constructed to expand with temperature without displacing or distorting the units. The units, arranged in vertical columns, are held together at the top by garter restraints of the same expansion coefficient, but at the bottom are left free to move radially outward with the steel support to which they are attached with spigots. Such a support arrangement gives less distortion of the core than if it had been tightly constrained throughout and/or supported on ball or roller bearings. (D.L.C.)

22546

IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS AND THEIR OPERATION. Philip James Garner. (to "Shell" Research Ltd.). British Patent 838,390. June 22, 1960.

A method is presented for operating a nuclear reactor in which the reaction zone is cooled and moderated by an aromatic hydrocarbon. The hydrocarbon is circulated from the reaction zone under conditions of temperature and pressure above critical values for hydrocarbons. (W.L.H.)

22547

FISSILE MATERIAL ELEMENTS AND METHOD OF PRODUCING FISSILE MATERIAL RODS FOR SUCH ELEMENTS. (to Sulzer Freres Societe Anonyme). British Patent 838,838. June 22, 1960.

The design of a metallic fuel element which consists of a fuel rod that is embedded in a cooling tube is presented. The fuel rod consists of a number of sections that are separated from one another and are arranged in a row along the cooling tube. (W.L.H.)

22548

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Norman Battle (to Rolls-Royce Ltd.). British Patent 840,010. July 6, 1960.

The design of fuel elements which have a large heat-transfer area to the coolant in relation to the quantity of fuel employed is described. The fuel elements consist of a number of thin rectangular sheets formed from clad fissionable material. Each sheet has parallel corrugations inclined to its lengthwise axis and the sheets are stacked with the corrugations on adjacent sheets in contact with and running across each other. The stack of sheets is contained in an open-ended tubular container adapted to have the reactor coolant pass through in a direction parallel to the planes of the sheets. (W.L.H.)

22549

IMPROVEMENTS RELATING TO NUCLEAR REACTORS. Derek Randall Smith and Roderick Sorlie McKean (to A.E.I.-John Thompson Nuclear Energy Co., Ltd.). British Patent 840,332. July 6, 1960.

The design of a coolant flow resistor for application to reactors in which the fuel is contained in vertical parallel channels is described. (W.L.H.)

22550

IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Edwin Philip Hotchen. (to United Kingdom Atomic Energy Authority). British Patent 841,545. July 20, 1960.

A fuel element design is presented for use in a gas-cooled reactor operating at high temperatures. The fuel element consists of fuel encased in a silica sheath with the sheathed fuel being contained in a block of solid neutron moderator material. (W.L.H.)

22551

HOMOGENEOUS NUCLEAR REACTOR FUEL COMPOSITION. (to North American Aviation, Inc.). British Patent 841,740. July 20, 1960.

A uranyl sulfate containing aqueous fuel composition for homogeneous reactors is reported. The fuel consists of about 75 to 750 g UO_2SO_4–17 to 600 mg metal sulfate–13 to 150 g H_2SO_4–water. (W.L.H.)

22552

IMPROVEMENTS RELATING TO NUCLEAR REACTORS.

Selchouk Ahmed Ghalib, George Erasmus Darwin, and Peter Raymond Joseph French. (to Metropolitan-Vickers Electrical Co., Ltd.). British Patent 841,992. July 20, 1960.

The development of fuel elements having a solid moderator such as graphite is reported. The fuel elements consist of two or more slabs of fuel material mounted in hollow ducting of solid graphite. The graphite is adapted for insertion in fuel passages in the reactor moderator. (W.L.H.)

22553

IMPROVEMENTS IN OR RELATING TO FERTILE MATERIALS FOR NUCLEAR REACTORS. Anthony Chitty. (to General Electric Co., Ltd.). British Patent 842,173. July 20, 1960.

A process is described for preparing a thorium oxide slurry of a low-melting-point metal or alloy. (W.L.H.)

22554

DEVICE FOR ARRESTING FALLING BODIES SUITABLE FOR NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). French Patent 1,125,220.

The device may be used for stopping the fall of a control rod in a nuclear reactor. It contains a first mechanism which starts to absorb the energy of the falling body up to a fixed value with the aid of a compression spring. After attaining this value, shear pins are destroyed and the body continues to fall. A second mechanism containing a cutting tool acts to stop the fall of the body. The cutting tool is mounted on a piston which cuts open the inside surface of a tube in order to absorb the remaining kinetic energy of the body. The inside surface of this tube has helicoidal grooves.

22555

FUEL ELEMENT CAN FOR NUCLEAR REACTORS. (to English Electric Co., Ltd.). French Patent 1,181,909. Jan. 12, 1959.

A cylindrical fuel element is described having on its external surface one or more helical fins and at least two longitudinal subdividing fins which can likewise be helical and can be so dimensioned that they center the fuel element in the fuel channel.

22556

PLATES CONTAINING METAL OXIDE INSERTIONS FOR NUCLEAR REACTORS. (to U. S. Atomic Energy Commission). French Patent 1,182,966. Jan. 19, 1959.

A fuel element, especially for boiling water reactors, consisting of several thick parallel Al plates, each containing parallel longitudinal borings, is reported. The borings contain a stack of cylindrical pellets consisting of ThO_2 and enriched UO_2 and a metal (preferably Pb) for the thermal contact between the pellets and the plate.

22557

HOMOGENEOUS FUEL ELEMENTS FOR NUCLEAR REACTORS. (to Deutsche Gold- und Silber-Scheideanstalt). French Patent 1,183,730. Feb. 2, 1959.

A practically homogeneous fuel element is described consisting of grains of fissile and/or fertile material (e.g., uranium + carbide), the largest dimension of the grains being smaller than the free path of the fission products (5 to 12 μ), and a moderating substance, and, optionally, an envelope of a nonmetallic porous material.

22558

METHOD FOR FUELING NUCLEAR REACTORS. (to U. S. Atomic Energy Commission). French Patent 1,183,732. Feb. 2, 1959.

In a series of nuclear reactors, the fuel elements belong to two series, one series moving successively through the reactors in one direction and the other series in the other. At any one time each reactor contains an equal amount of fuel from the two series of elements. This "countercurrent" movement of the fuel elements leads to an equilibrium state in which the two "outer" reactors are each fueled to half capacity with elements containing natural uranium, the other half being made up of almost spent elements which have traversed all the other reactors; the amount of U^{235} in the latter elements in such that, in combination with the natural uranium, a chain reaction can just be maintained. In intermediate reactors half of the fuel contains more U^{235} than the average concentration necessary for maintenance of a chain reaction, and half contains less. After consumption of a definite percentage of U^{235} in each reactor, the fuel is freed from Pu and fission products and is passed on to the appropriate next reactor; spent elements are removed from the two "outer" reactors. In this way a higher burn-up of the U^{235} can be achieved.

22559

FUEL ELEMENT OF A NUCLEAR REACTOR. Karel Vlacil. French Patent 1,184,573. Feb. 9, 1959.

The U is placed in a can with a suitable play and the annular space is filled with a low-melting metal. The U is built up of relatively small parts of a suitable shape. Above the level of the low-melting metal is a space which is evacuated or filled with an inert gas.

22560

ELEMENT CONTAINING FISSILE AND FERTILE MATERIAL FOR A NUCLEAR REACTOR. (to U. S. Atomic Energy Commission). French Patent 1,186,273. Feb. 23, 1959.

The element consists of a cylindrical core of fertile material (Th) surrounded by a first bonding agent, a layer of fissile material (U), a second bonding agent, and the canning (Zr). The bonding agent can be molten fluorides, sodium, sodium–potassium, bismuth, or bismuth–tin. Several such elements with axial openings can be attached to a stem and provided with a common envelope.

22561

ELEMENTS CONTAINING FISSILE AND FERTILE MATERIAL FOR A NUCLEAR REACTOR. (to U. S. Atomic Energy Commission). French Patent 1,186,274. Feb. 23, 1959.

The element consists of a core of a solid fertile material (Th) surrounded by a nonaqueous liquid containing the fuel, and a canning. The liquid can consist of fluorides, bismuth, or bismuth–tin, in all three cases in admixture with uranium–bismuth or with a mixture of fluorides of uranium, zirconium, and sodium.

22562

FUEL CARTRIDGE FOR ATOMIC PILES. (to United Kingdom Atomic Energy Authority). French Patent 1,186,581. Feb. 23, 1959.

A cylindrical fuel cartridge having longitudinal fins and also one or more helical fins supporting the cartridge in a socket of graphite is described. The helical fins can be made of graphite; they are wider than the longitudinal fins and they have slots to accommodate the longitudinal fins.

22563

NUCLEAR REACTOR. (to Westinghouse Electric Corp.). French Patent 1,187,050. Mar. 2, 1959.

A nuclear reactor is described consisting of a first vessel in which is situated a second vessel provided with a plurality of openings at the upper and lower sides. Between the openings are tubes in which are inserted fuel elements, control rods, and objects to be exposed to radiation, heat, and pressure. Water under pressure is arranged to circulate in the first vessel through the tubes and cool the fuel

elements. Moderating fluid is arranged to circulate past the tubes in the second vessel. The fuel elements consist of a number of loosely fitting concentric cylinders containing the fuel. The cylinders are held together at the upper and lower ends in such a way that the coolant can flow past the various cylinders. The control rods consist of a neutron-absorbing element and a fuel element, placed in line.

22564

FUEL ELEMENTS FOR ATOMIC PILES. (to United Kingdom Atomic Energy Authority). French Patent 1,187,405. Mar. 2, 1959.

A high-temperature fuel element for gas-cooled reactors is described, consisting of a substantially impermeable graphite tube, a sectional graphite bar which is axially disposed in the tube by means of a number of graphite spacers, a number of graphite sleeves containing fissile or fertile material which are loosely piled up between the spacers, and graphite end reflectors, one of these being provided with a ventilation channel for the removal of fission gases. Seven of these elements are assembled by means of graphite supporting devices. Beryllium may be used everywhere instead of graphite.

22565

LIQUID MODERATOR. (to Siemens-Schuckertwerke Aktiengeselleschaft). French Patent 1,189,157. Mar. 23, 1959.

A liquid moderator or reflector is described consisting of an aqueous solution of mineral substances with favorable nuclear properties as to produce a volume contraction. Examples are a solution of $Li^{7}OD$ or BeF_2 in heavy water or of LiOH or BeF_2 in light water.

22566

NUCLEAR REACTOR WITH MULTIPLE ELEMENTS. A. Huet. French Patent 1,189,581. Mar. 23, 1959.

A nuclear reactor is reported in which the fuel elements are contained in a number (e.g., 9) of separate reactor vessels which are interconnected by means of a number (e.g., 3) of short, wide tubes. Each vessel is provided with a coolant and moderator inlet and outlet and a central tube for the introduction of a control rod, supplementary fuel, etch. The subdivision of the customary large reactor vessel into a number of relatively small vessels facilitates construction, repair, and replacement.

22567

ATOMIC PILES. (to United Kingdom Atomic Energy Authority). French Patent 1,189,743. Mar. 23, 1959.

A fuel element for spiking a nuclear reactor is described, consisting of a mixture of a refractory Pu compound (preferably PuO_2 or Pu_3O_8) and graphite, enveloped by a protective can. A useful composition is 0.1 g Pu per cm^3 graphite.

22568

MODERATING SUBSTANCE FOR NUCLEAR REACTORS IN BLOCK FORM. (to Siemens-Schuckertwerke Aktiengesellschaft). French Patent 1,189,947. Mar. 31, 1959.

The invention consists of moderator blocks with a central channel which are provided on their outer surfaces with flat longitudinal ribs. In constructing the moderator body, the blocks are assembled in such a manner that only the ribs touch each other and the channels are aligned. A dual channel system is thus formed, the central channels serving as fuel channels and the other channels serving for the separate passage of the reactor coolant.

22569

FUEL ELEMENT FOR ATOMIC PILE. (to United Kingdom Atomic Energy Authority). French Patent 1,190,469. Mar. 31, 1959.

A longitudinally finned fuel element is described, the fins of which are indented at intervals and curved between the indentations to give the coolant gas a circumferential as well as a longitudinal flow along the element. The coolant flow is further directed by means of radial splitters which are placed at regular intervals along the circumference of the element and also serve to center the element in a reactor channel. The fuel element can with fins and splitters can be economically manufactured by extrusion.

22570

NOVEL SEALING METHOD FOR A CHANNEL OF A NUCLEAR REACTOR WITH SOLID MODERATOR. (to Commissariat à l'Énergie Atomique). French Patent 1,193,302.

An improved method is described for sealing the channels of a gas-cooled nuclear reactor. This method suppresses fluid losses in the connection of the solid moderator blocks which are joined together with interlocking keys and keyways. A sealing piece made of the moderator material, having a hole coaxial with the channel, is interposed between the moderator blocks. The planes of contact of this sealing piece with the blocks are worked perpendicularly to the direction of minimum Wigner growth. The sealing piece coacts with a cylindrical surface relatively to the connection means in a male or female manner according to the principal directions of Wigner growth of the assembled blocks.

22571

PRESSURE VESSEL FOR NUCLEAR REACTORS. (to English Electric Co., Ltd.). French Patent 1,194,027.

A heat-insulating barrier mounted on the inner surface of a pressure vessel for a nuclear reactor is described. This barrier covers the inner surface of the upper part of the vessel down to a height lower than the top surface of the moderator. The barrier consists of packages of corrugated plates between which stagnant gas is retained. The corrugated plates are in contact with the directions of the corrugations of consecutive plates crossed and are held together by rivets which are provided with tubular spaces. An exterior shell covers the outside of the upper part of the vessel and forms with the outer surface of the vessel a narrow space in which a cooling fluid circulates.

22572

SUPPORT STRUCTURES FOR THE FUEL ELEMENTS OF AN ATOMIC PILE. (to United Kingdom Atomic Energy Authority). French Patent 1,194,777. May 11, 1959.

The star-shaped core of a fast reactor consists of a hexagonal lattice of alternate long and short cylindrical tubes, locally provided with flat surfaces and staggered slits to enable close contact and intersection of the tubes. The long tubes are fixed to perforated bottom and top tube plates, which are connected to the restraining core envelopment. Tubular fuel elements, provided with groups of helical fins, are placed in and between the tubes and supported by the tube plates, the fins acting as spacers at the tube intersection places. Corresponding slits in the flat parts of the tubes enable passage of coolant from one tube to another.

22573

NUCLEAR REACTOR. (to English Electric Co., Ltd.). French Patent 1,195,014.

Control means for nuclear reactors are described consisting of a cable or chain which is movable inside the reactor, contains neutron absorbing materials, and can pass over a pulley and/or be controlled in its movement by the rotation of the pulley. The latter may also be arranged to roll up this cable or chain, to which are attached neutron absorbing elements, to maintain the control means in a retracted position.

22574
FUEL ELEMENT. (to Escher Wyss, Soc. Anon.). French Patent 1,196,192. May 25, 1959.

A fuel element for a gas-cooled reactor is described, consisting of two coaxial perforated ceramic tubes (BeO or ZrO_2), between which particulate fissile material is applied. The coolant gas is forced to enter the perforations of the outer tube and to leave the element through the inner tube. The fuel element can be directly introduced into a reactor channel or can be surrounded by a coaxial Al or Zr pressure tube.

22575
ATOMIC PILE AND METHOD OF MANUFACTURE. (to Sulzer Frères, Soc. Anon.). French Patent 1,196,445. May 25, 1959.

A fuel element assembly is described comprising a number of oblong regularly shaped fuel bodies, interiorly provided with one or more longitudinal (firmed) coolant channels, which are so arranged within a containment tube as to form some regular geometrical pattern.

22576
FUEL ELEMENT FOR ATOMIC PILE AND METHOD OF MANUFACTURE. (to Sulzer Frères, Soc. Anon.). French Patent 1,197,317. June 1, 1959.

A tubular fuel element, consisting of a zirconium tube provided with an external jacket of fissile material, is reported. The jacket is subdivided by means of radial perforated graphite interlayers and also provided with longitudinal and/or transverse slits; it is manufactured by induction melting fissile material around the tube. The construction of the fuel element prevents permanent deformation and localizes detachment of fuel from the tube during reactor operation. A number of these fuel elements are assembled in a graphite tube, the interstices being filled with graphite powder. This assembly is enveloped by an Al tube which is separated from the graphite tube by a heat-insulating layer.

22577
NUCLEAR BREEDER REACTOR. (to General Electric Co., Ltd.). French Patent 1,197,547. June 1, 1959.

A liquid fertile composition is given, comprising a liquid metal carrier to which is added 50 wt.% ThO_2. To improve wetting of the ThO_2 particles by the liquid metal, the composition is agitated in an inert atmosphere with minor amounts of Al, Ba, Ca, Fe, Mn, Si, Na, Tl, U, Zn, or Zr at such a temperature that the added material does not melt.

22578
STRUCTURE OF FUEL ELEMENTS FOR ATOMIC REACTORS. (to Commissariat à l'Énergie Atomique). French Patent 1,197,912. June 8, 1959.

Fuel element assemblies, comprising a number of regularly arranged small diameter fuel rods which are interconnected by means of common full-length longitudinal fins, are described.

22579
ENVELOPMENT OF FUEL ELEMENTS OF A BOILING NUCLEAR REACTOR. A. Huet. French Patent 1,200,880. July 6, 1959.

A group of vertical fuel rods of a boiling reactor is concentrically or eccentrically arranged within a cylindrical, parabolic, or hyperbolic envelope, the inner surface of which may be provided with helical fins and to the interior of which the liquid has free access. By applying a rotatory or epicyclic movement to the envelope, the disengagement of vapor bubbles from the surface of the fuel elements is achieved.

22580
DEVICE FOR RADIATION SHIELDING IN NUCLEAR REACTORS. Kurt Diebner. German Patent DAS 1 052 587. Mar. 12, 1959. Kerntechnik 2, 262(1960) July-Aug. (In German)

An installation for shielding gamma and neutron radiation from reactors is designed by use of a neutron absorbing hydrogen-rich liquid in almost homogeneous mixture with solid absorbents of high atomic weight, which is placed in cavities surrounding the reactor. The solid absorbents have the form of short hollow cylindrical bodies similar to Raschig rings, which together with the liquid are statistically distributed around the reactor. The cavity containing the mixture is divided into chambers and provided with outlet and inlet orifices which permit the circulation of the liquid during reactor operation to remove the heat originating in the reactor shields.

22581
VARIABLE AREA CONTROL ROD FOR NUCLEAR REACTOR. N. E. Huston (to U. S. Atomic Energy Commission). U. S. Patent 2,935,456. May 3, 1960.

A control rod is described which permits continual variation of its absorbing strength uniformly along the length of the rod. The rod is fail safe and is fully inserted into the core but changes in its absorbing strength do not produce axial flux distortion. The control device comprises a sheet containing a material having a high thermal-neutron absorption cross section. A pair of shafts engage the sheet along the longitudinal axis of the shafts and gears associated with the shafts permit winding and unwinding of the sheet around the shafts.

22582
REACTOR CONTROL SYSTEM. J. H. MacNeill and J. Y. Estabrook (to U. S. Atomic Energy Commission). U. S. Patent 2,936,277. May 10, 1960.

A reactor control system including a continuous tape passing through a first coolant passageway, over idler rollers, back through another parallel passageway, and over motor-driven rollers is described. Discrete portions of fuel or poison are carried on two opposed active sections of the tape. Driving the tape in forward or reverse directions causes both active sections to be simultaneously inserted or withdrawn uniformly, tending to maintain a more uniform flux within the reactor. The system is particularly useful in mobile reactors, where reduced inertial resistance to control rod movement is important.

22583
CONTROL ROD DRIVE. R. A. Chapellier (to U. S. Atomic Energy Commission). U. S. Patent 2,937,984. May 24, 1960.

A drive mechanism was invented for the control rod of a nuclear reactor. Power is provided by an electric motor and an outside source of fluid pressure is utilized in conjunction with the fluid pressure within the reactor to balance the loadings on the motor. The force exerted on the drive mechanism in the direction of scramming the rod is derived from the reactor fluid pressure so that failure of the outside pressure source will cause prompt scramming of the rod.

22584
NUCLEAR FUEL COMPOSITION. F. H. Spedding and H. A. Wilhelm (to U. S. Atomic Energy Commission). U. S. Patent 2,938,784. May 31, 1960.

A novel reactor composition for use in a self-sustaining fast nuclear reactor is described. More particularly, a fuel alloy comprising thorium and uranium-235 is de-

scribed, the uranium-235 existing in approximately the same amount that it is found in natural uranium, i.e., 1.4%.

22585

NEUTRONIC REACTOR COUNTER METHOD AND SYSTEM. C. B. Graham and I. Spiewak (to U. S. Atomic Energy Commission). U. S. Patent 2,938,844. May 31, 1960.

An improved method is given for controlling the rate of fission in circulating-fuel neutronic reactors in which the fuel is a homogeneous liquid containing fissionable material and a neutron moderator. A change in the rate of fission is effected by preferentially retaining apart from the circulating fuel a variable amount of either fissionable material or moderator, thereby varying the concentration of fissionable material in the fuel. In the case of an aqueous fuel solution a portion of the water may be continuously vaporized from the circulating solution and the amount of condensate, or condensate plus make-up water, returned to the solution is varied to control the fission rate.

22586

SUPERHEATING IN A BOILING WATER REACTOR. M. Treshow (to U. S. Atomic Energy Commission). U. S. Patent 2,938,845. May 31, 1960.

A boiling-water reactor is described in which the steam developed in the reactor is superheated in the reactor. This is accomplished by providing means for separating the steam from the water and passing the steam over a surface of the fissionable material which is not in contact with the water. Specifically water is boiled on the outside of tubular fuel elements and the steam is superheated on the inside of the fuel elements.

Power Reactors

22587 AEPSC-598

American Electric Power Service Corp., New York.

ECNG—FWCNG—PROTOTYPE POWER PLANT GAS-COOLED REACTOR PROJECT. Progress Report No. 1. Mar. 20, 1959. 168p. For East Central Nuclear Group and Florida West Coast Nuclear Group, Inc. OTS.

The American Electric Power Service Corporation has been engaged in the conceptual design and feasibility study of a 50 Mw(e) nuclear power plant for the Florida West Coast Nuclear Group. This plant incorporates an advanced gas-cooled, heavy-water moderated, pressure tube-type reactor. The 50 Mw(e) plant, scheduled for initial operation in 1963, is to serve as a prototype for a larger plant of approximately 200 Mw(e) capacity utilizing a reactor of similar design but fueled with natural uranium. Much of the effort to date has been devoted to a program of cycle analyses. Integrated with these studies has been a broad investigation of cycle components, particularly in those areas which have a minimum of design precedence. The simplest arrangement of a single-pressure non-reheat cycle was adapted as a reference design. Basic schemes were developed for supply, purification, and handling of the reactor coolant and moderator. In electrical design, initial layouts were made for the high voltage and plant auxiliary systems. Control studies are proceeding on the analysis of steam generator characteristics. Plant layouts were restricted to those areas requiring basic decisions on alternate approaches, i.e., horizontal vs. vertical reactor, fuel handling, containment requirements, steam generator, and reactor cooling piping arrangements. A preliminary construction schedule is included. (W.D.M.)

22588 AERE-R-3216

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

METHODS OF CALCULATION FOR USE IN THE DESIGN OF SHIELDS FOR POWER REACTORS. A. F. Avery, D. E. Bendall, J. Butler, and K. T. Spinney. Feb. 1960. Decl. May 25, 1960. 192p. BIS.

Recommendations are given on methods of calculation for use in the design of shields for the gas cooled, graphite moderated, natural uranium reactors of the U.K. Civil Power Program. Topics dealt with include: primary shielding of neutron and gamma radiation, nuclear heating, coolant activation, fission product energy decay rates, and radiation streaming in ducts. A new method of calculating neutron penetration is introduced and compared with experimental measurements in a Calder Hall Reactor shield. (auth)

22589 APAE-Memo-234

Alco Products, Inc., Schenectady, N. Y.

ENGINEERING STUDY OF METHODS FOR DECONTAMINATION OF SM-2. Feb. 15, 1960. 36p. Contract DA-44-192-ENG-7.

Partial and full system decontamination methods were evaluated for decontaminating the Army Reactor (SM-2). The partial methods evaluated include: fixed tube bundle, removable tube bundle, and isolation valve decontaminations. The results indicated that full system decontamination is more advantageous. (C.J.G.)

22590 APAE-Memo-265

Alco Products, Inc., Schenectady, N. Y.

VIBRATION AND COLLAPSE TESTING OF SM-2 FUEL ELEMENTS. [Period covered]: January 1959 to January 1960. D. J. Morehouse and J. A. Christenson. July 5, 1960. 53p. Contract AT(30-3)-326. OTS.

Experiments were conducted on SM-2 fuel elements to determine the presence of flow-induced fuel plate vibrations, their frequency and amplitude, and to verify the ability of welded fuel elements to resist any tendency towards a flow-induced channel collapse. Test facilities, instrumentation, and procedures are described in detail. Results of tests showed that vibrations are practically non-existent in SM-2 welded fuel elements, welded fuel elements will effectively oppose channel collapse, and the addition of combs at the leading and trailing edges of the fuel plates will eliminate any possibility of flow-induced channel collapse at higher than normal flow rates, and insure vibration-free operation. (auth)

22591 ASAE-S-13

American-Standard. Atomic Energy Div., Mountain View, Calif.

ECONOMICS OF NUCLEAR AND CONVENTIONAL TANKERS. Jack J. Gordon and Keith E. Buck. Oct. 10, 1958. 71p. Contract AT(04-3)-109. OTS.

This is a supplementary report to ASAE-S-5.

The work performed augments that portion of ASAE-S-5 devoted to a study of the economics of nuclear tankers by presenting economic data on three additional tanker sizes, each driven at three different speeds. Some of the previous data are repeated to facilitate direct comparison of the different ship sizes. Operating costs and return on investment are tabulated for all six ship sizes on three specific trade routes. (W.D.M.)

22592 BAW-1200

Babcock and Wilcox Co. Atomic Energy Div., [Lynchburg, Va.].

PRELIMINARY EVALUATION OF MATERIALS FOR USE

ITH A GAS-SUSPENSION COOLANT. G. E. Uhland. uly 1960. 35p. Contract AT(30-1)-2316. OTS.

A literature survey was made as a preliminary to the as-suspension materials compatibility studies. Its purose was to gather information from related programs and valuate it in terms of the gas-suspension concept. Nitroen and helium are the carrier gases under active conideration. The reactions involving these gases were ostulated. Information gathered showed that nitrogen can eact with graphite and metals. It was also found that arbonaceous gases or graphite can embrittle metals rough carburization. Helium is chemically inert, but reep strength of metals in a helium atmosphere is lower an in air. Methods for reducing the effects of or elimiating carburizing and nitriding are discussed. Off-gassing graphite is shown to be a way of reducing gas impurities an operating system. Powdered graphite was shown to elease about ten times the gas volume released by block raphite. The formation of sigma (FeCr) was found to be a otential problem if stainless steels are used at high temeratures. It was concluded that nitriding and carburizing ould be prevented in gas-cooled systems by means of arrier coatings, although the feasibility of such coatings r gas-suspension must be checked. Helium compatibility termed a lesser problem than nitrogen and carbon diide compatibility. Subjects that require further testing re cyanogen formation, possible erosion, sigma formaon, nitriding and carburizing. (auth)

2593 CF-59-8-87(Rev.)

ak Ridge National Lab., Tenn.

OWER DENSITY IN CERAMIC-FUEL-ELEMENT GAS-OOLED REACTORS. R. S. Carlsmith. Aug. 14, 1959. 5p. Contract [W-7405-eng-26]. OTS.

The maximum practical power density for ceramic-fuelement gas-cooled reactors was studied. It appears that 0 to 200 w/cm^3 is attainable with uranium bearing graphe and 50 to 100 w/cm^3 with uranium bearing BeO. (auth)

2594 CF-60-6-123

ak Ridge National Lab., Tenn.

HIELDING OF PIPES IN THE HFIR PRIMARY COOLANT YSTEM. H. A. McLain and L. A. Haack. June 30, 1960. p. Contract W-7405-eng-26. OTS.

The thicknesses of ordinary concrete required to shield pes in the ORNL High Flux Isotope Reactor primary ater system were computed for normal operating conditons and for abnormal conditions such as a defective fuel ate or a meltdown of the fuel within the reactor. About ft of concrete is required for the pipes at the outlet of e reactor, and 2 ft of concrete is required for the pipes cated about 1½ min downstream from the reactor vessel. ese thicknesses of concrete reduce the radiation levels below the specified tolerances of: (a) 0.75 mr/hr during rmal operation or operation with one defective fuel plate;) 1 r/hr immediately after the meltdown of 1% of the fuel; d (c) 1 r/hr 24 hr after a total fuel meltdown. Shielding icknesses required for other tolerances may be estimated om graphs and tables which are presented. (auth)

2595 CF-60-7-71

ak Ridge National Lab., Tenn.

ADIATIVE HEAT TRANSFER IN MULTISURFACED NON-LACK ENCLOSURES WITH APPLICATION TO THE GCR FUEL BUNDLE. L. G. Epel. July 22, 1960. 11p. OTS.

In an investigation of the detailed temperature structure the seven-element cluster of cylinders surrounded by sleeve which comprise the fuel assembly for the EGCR, radiative interchange of heat between the rods and sleeve was evaluated. A procedure advocated by Hottel was used to determine the view factors for gray enclosures taking into account the multiplicity of reflections, absorptions, and secondary radiations. (auth)

22596 GEAP-3294

General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.

NUCLEAR POWERED TANKER DESIGN AND ECONOMIC ANALYSIS, DIRECT CYCLE BOILING WATER REACTOR. Dec. 15, 1959. 282p. Contract AT(04-3)-189. OTS.

A design and economic analysis is presented for a 44,000 DWT tanker utilizing a 27,300 shp direct cycle boiling water reactor propulsion system. Included are design descriptions and drawings, estimates of operating and capital costs for the reference ship, estimates of long range potential, descriptions of required research and development programs, a preliminary safeguards analysis, an analysis of effects of ship's motion on boiling water reactor performance, a summary reactor physics analysis, and a discussion of direct cycle accessibility considerations. Also included are summary descriptions for various design alternatives which were considered. (auth)

22597 HPR-6

Norway. Institutt for Atomenergi. OEEC Halden Reaktor Prosjekt.

HBWR VOID EXPERIMENTS. G. Bernander, P. E. Blomberg, A. Drageseth, C. F. Højerup, and G. Ingram. June 1960. 83p.

Measurements of the void reactivity effect in the Halden Boiling Reactor (HBWR) were made at room temperature as a function of the position and the void fraction using the pile oscillating technique. The voids were introduced by oscillating the water level inside aluminum shrouds, both with and without fuel rods inside. Measurements were made with different core sizes, the excess reactivity due to an increased water level being compensated by insertion of control rods. The interaction effects of voids were investigated by introducing static voids in annular channels adjacent to the oscillated channel and by introducing static voids within the shrouds of the neighboring six fuel elements. Calculations were made of changes in: the neutron absorption and slowing down parameters, effective axial diffusion coefficient, and the effective radial diffusion coefficient. The results were in good agreement with experimental values. The effect of neutron streaming was calculated by the formulas of Behrens and Benoist. (C.J.G.)

22598 IDO-19008

Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.

ABWR PL-2 REFERENCE DESIGN REPORT. Jan. 15, 1960. Includes Appendices: I. OXYGEN REMOVAL FROM REACTOR WATER BY A COPPER AMMINE COMPLEX EXCHANGE RESIN. A. S. Powell and E. V. Falcone. Dec. 18, 1959. (CEND/2407/RS/68). II. TESTS OF REMOVAL OF ORGANIC MATERIALS FROM RAW WATER BY AN EXCHANGE RESIN. Interim Report. A. S. Powell and E. V. Falcone. Jan. 4, 1960. (CEND/2407/RS/72). III. NOTES ON ARCTIC CONSTRUCTION. F. A. Devlin. Jan. 4, 1960. 161p. Contracts AT(10-1)-967 and DA-44-192-ENG-11. (CEND-71). OTS.

Appendix III prepared by the Lummus Co. under Subcontract No. 1 to Contract AT(10-1)-967.

The reference design of a Portable Boiling Water Reactor Plant with a net electric output of up to 1000 kw and a net space heat output of 400 kw is presented. The total reactor thermal power is 8.8 Mw and the design life of the core is three full power years. The principle objectives

which governed the reference design are: (1) The plant should be air transportable by C-130A aircraft. (2) The plant should be designed for minimum installed cost consistent with a maximum degree of reliability. (3) The plant should be designed for minimum down time. This design is a development of the SL-1 prototype which has operated successfully for more than one year. Automatic reactor pressure control by rod motion, direct air condensing with air recirculation, and the use of condensate for auxiliary coolant are concepts which have been successfully demonstrated at the prototype facility. (auth)

22599 NAA-SR-183
North American Aviation, Inc., Downey, Calif.
COMPARATIVE STUDY OF H_2O AND D_2O AS MODERATORS FOR HETEROGENEOUS PRESSURIZED REACTORS FOR PRODUCTION OF PLUTONIUM AND USEFUL POWER. E. F. Weisner. May 23, 1952. Decl. Mar. 4, 1960. 39p. Contract AT-11-1-GEN-8. OTS.

An attempt is made to compare the relative merits of light and heavy water as moderating materials for pressurized, uranium-fueled reactors which operate at temperatures high enough to enable useful power to be generated. Because of the inherent need for pressurization with water moderated reactors, in which the moderator operates above its atmospheric saturation temperature, and because of the engineering limitations which exist on the size of pressure vessels, the comparison between these materials is made on the basis of the same reactor volume. In other words, within a given pressure vessel, which moderator (H_2O or D_2O) will allow plutonium to be produced more economically (and therefore can be considered as the better moderator for this type of reactor)? The actual size and shape of the pressure vessel, however, remain as variables. The enrichment is also a variable and, further no strategic value is placed on the use of natural uranium fuel per se. The costs associated with each of these two reactor systems are compared, and it is concluded that, under these conditions (i.e., limitation to same reactor volume and no premium on natural uranium fuel), light water always produces the more economical product. (auth)

22600 NAA-SR-4873
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
300,000-KWE SGR NUCLEAR POWER PLANT OF CURRENT TECHNOLOGY. J. Renard, C. L. Peckinpaugh, and R. E. Aronstein. Aug. 1, 1960. 148p. Contract AT-11-1-GEN-8. OTS.

A 300 Mw(e), sodium-cooled, graphite-moderated nuclear power plant based on existing technical information is described. The plant produces high-pressure, high-temperature steam to generate electricity at a thermal efficiency of 36.8%. The total plant capital cost including indirect construction costs, contingency, and interest during construction, but excluding escalation, is estimated to be $186/kw. Estimated cost of power generation is 7.86 mills/kw-hr. All components of the plant are within the capability of current technology. Plant design is based on experience with the Sodium Reactor Experiment and on design and development information from the Hallam Nuclear Power Facility program. (auth)

22601 NAA-SR-5070
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
ADVANCED OMR COOLANT SCREENING AND BOILING TEST LOOPS. J. E. Leary and D. A. Huber. July 30, 1960. 33p. Contract AT-11-1-GEN-8. OTS.

The design and construction of two heat-transfer loops, the Coolant Screening Loop and the Boiling Heat Transfer Loop, are discussed. These loops were designed and instrumented to permit unattended operation for extended periods of time and to conduct heat transfer tests at high temperatures with organic coolants. (auth)

22602 NAA-SR-Memo-2763
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
HNPF PLANT HEAT BALANCES FOR A DESIGN GROSS LOAD OF 86 eMW. T. L. Gershun. June 20, 1958. 20p. OTS.

The heat balances necessary for the Hallam Power Reactor to meet a gross load demand of 86 Mw(e) when the turbine is operating on a 3-heater cycle were calculated. (C.J.G.)

22603 NAA-SR-Memo-2881
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
DESIGN OF AN EDDY-CURRENT BRAKE FOR A SODIUM-COOLED NUCLEAR POWER REACTOR. R. S. Baker. July 10, 1958. 17p. OTS.

Two eddy-current electromagnets to act as brakes were designed and installed in the sodium-cooled nuclear power reactor SRE to throttle sodium flow throughout the reactor after shutdown in order to maintain a constant reactor temperature gradient. One brake was used on the primary piping system, the other on the secondary system. It was determined that the eddy-current brake should cause a dragging pressure of 0.3 psi at a flow rate of 12 gal/min. The flux density necessary to produce this pressure was calculated, and the coil ampere-turns required to produce this flux density were determined. Both brakes were controlled by thermocouples and performance was satisfactory. (M.C.G.)

22604 NAA-SR-Memo-3523
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
REACTIVITY OF A ZIRCALOY II THIMBLE IN THE SRE. R. W. Woodruff. Jan. 27, 1959. 9p. OTS.

The gain in reactivity of replacing eight stainless steel control thimbles with thimbles of Zircaloy-2 in the Sodium Reactor Experiment was (1.84 ± 0.07)% at 338°F. This is equivalent to 5.1 ± 0.2 peripheral fuel elements, which is in agreement with the calculated value of 5 ± 1. (C.J.G.)

22605 NAA-SR-Memo-4334
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
HNPF PROCESS TUBE–GRID SEAL. J. Charles. Aug. 19, 1959. 18p. OTS.

A maximum leak rate of 0.08% was measured for a piston ring seal assembly which was evaluated for use as the Hallam Power Reactor process tube-grid plate seal. A maximum leak rate of 0.14% was observed after subjection to 10,000 cycles (560 hr) in 625°F Na. The maximum leak rate was 0.07% after 25 cycle exposure in 1000° Na. Vertical scoring of both the rings and bore tube was observed. Sodium was observed to remain behind the rings after washing. (C.J.G.)

22606 NAA-SR-Memo-4346
Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.
LOAD-DEFLECTION TESTS OF HNPF REACTOR VESSEL BELLOWS. G. M. Merritt. Sept. 8, 1959. 9p. OTS.

Displacement tests consisting of applying axial loads up to 515 lb to the Hallam Power Reactor vessel bellows were performed. Elongation and strain data were recorded at various points. (C.J.G.)

2607 NAA-SR-Memo-5166

tomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

NAP II REACTOR CORE MATERIALS. J. V. Facha. pr. 11, 1960. 12p. Contract [AT-11-1-GEN-8]. OTS.

A survey was made to select the construction materials or the SDR-1 reactor core vessel and grid plates. Hastelloy C was selected for the reactor vessel, top grid plate, nd bottom grid plate. Inconel X was selected for the core old-down springs. (C.J.G.)

2608 NAA-SR-Memo-5218

tomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

EST RESULTS ON THE POWER/FLOW COMPARATOR ND FLOW/FLOW RATIO COMPUTER FOR THE HNPF LANT PROTECTIVE SYSTEM. E. J. Westerweller. pr. 25, 1960. 12p. OTS.

The power/flow comparator and flow/flow computer of e Hallam Power Reactor Plant Protective System were ubjected to various input signals to measure the response me of the circuit. Tests to determine the drift, hysteres, and repeatability of trip points were performed. The struments were found to conform to the system description. (C.J.G.)

2609 NAA-SR-Memo-5222

tomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.

ESIGN TESTS, FUEL CHANNEL EXIT TEMPERATURE ND RATE CHANGE OF TEMPERATURE CIRCUITS. . E. Brown and E. J. Westerweller. Apr. 26, 1960. 11p. TS.

The performance of circuits for fuel channel exit temerature and rate change of temperature in the plant proctive system of the Hallam Power Reactor is reported. he circuits were found to perform within the required ecifications. (C.J.G.)

2610 NYO-2708

rginia. Univ., Charlottesville. Research Labs. for Engineering Sciences.

ONCERNING SEVERAL METHODS FOR THE REMOVAL F FISSION PRODUCTS FROM A GAS COOLED REACOR. K. H. Quasebarth, H. M. Parker, and A. R. Kuhlthau. eb. 1960. 32p. For Sanderson and Porter. Contract T(30-1)-2207, S and P Subcontract 1965-3. OTS.

Originally issued as EP-2883-2-60U.

Several methods for the removal of contaminants from a s-cooled reactor loop are considered. These include atic adsorption techniques in which the gas is passed rough an adsorbing bed, and dynamic techniques in which e adsorbent is recirculated with the coolant gas. Data on sorption under loop conditions are essentially nonistant. Extrapolations from available adsorption measements are severe and must be regarded with caution, t they indicate that, in general, the adsorbing must be ne at room temperature or below. Preliminary experients of at least two research groups have shown that reculation of suspended solids in the loop gas stream appars feasible. Adsorption data on such very small rticles is not available. Since the suspended adsorbent ers a surface area of the order of 10^5 to 10^8 times that the loop walls, there appears to be a good possibility t the solid daughters of the volatile fission products y, if permitted to form, plate out preferentially on the spended solids and leave the loop walls at a reasonably v level of activity. This approach seems to offer much ter possibilities for contaminant removal than adsorpn techniques involving the volatile products and it is recommended that further study be directed in this area. A detailed analysis for processing the entire loop flow and removing, by an ultracentrifuge, the suspended solids, if necessary or desirable, is appended. (auth)

22611 PRDC-TR-33

Power Reactor Development Co., Detroit.

MONTHLY TECHNICAL REPORT [FOR] MARCH 1960. 30p. Contract AT(11-1)-476. OTS.

A preliminary fuel bundle using two fuel cartridges of half-length fuel plates was designed for Type B core loading for the Fermi Fast Breeder Reactor. The effect of decay power of fission products on reactor kinetics was investigated. For Type A core, equilibrium core and blanket compositions and loading were determined for the Na-bonded pin. Axial and radial variations in blanket heating were determined. Gas generation rates in the neutron source and in the Zr–5 wt. % Be brazing alloy were determined. Modifications to the shielding of the offset handling mechanism are discussed. Various tests performed on the Reactor Components Test Facility and fuel element endurance are described. (For preceding period see PRDC-TR-32.) (C.J.G.)

22612 TID-8208

Office of Operations Analysis and Forecasting, AEC.

STATE REGULATIONS AND THE FUTURE OF NUCLEAR POWER. Ray E. Untereiner. June 1960. 15p. OTS.

State regulations regarding research expenditures, plant construction, capital costs, fuel and insurance costs, and other regulatory aspects of a nuclear power plant are summarized. (C.J.G.)

22613 TID-8502(Pt.1)(Suppl.)

Stone and Webster Engineering Corp., Boston and Combustion Engineering, Inc., New York.

ADVANCED PRESSURIZED WATER REACTOR STUDY. PHASE II-A REPORT. July 1959. 364p. Contract AT (10-1)-1010. OTS.

A feasibility study of an advanced pressurized water reactor (APWR) was made. The reactor plant is discussed relative to power distribution improvement by core zoning, power control by discrete burnable poison, power oscillations induced by Xe, and main coolant fission product activity. Economics and efficiency of the turbine generator plant are discussed. The economics of a 300 Mw(e) plant which employs an APWR are considered. The economic and feasibility analysis of Zircaloy clad cores and spiked core reactors is given. A description and evaluation of main coolant purification systems and various vapor containers are presented. A self-pressurized reactor system and a nuclear plant with fossil-fuel superheat are discussed relative to turbines, all systems and auxiliaries, and estimated costs. (C.J.G.)

22614 TID-8518(Bk. 2)

Atomic Energy Commission, Washington, D. C.

CIVILIAN POWER REACTOR PROGRAM. PART III. BOOK 2. STATUS REPORT ON PRESSURIZED WATER REACTORS AS OF 1959. 1960. 89p. GPO.

The status of pressurized water reactors on a technical, economic, and operating experience basis is reported. Items covered include concept description, PWR objectives, general research and development program, reactor data, reactor illustrations, operating experience, construction and operation schedules, and present limitations and problems. (W.D.M.)

22615 TID-8518(Bk. 6)

Atomic Energy Commission, Washington, D. C.

CIVILIAN POWER REACTOR PROGRAM. PART III.

BOOK 6. STATUS REPORT ON SODIUM GRAPHITE REACTORS AS OF 1959. 1960. 57p. GPO.

The current development status of the sodium graphite reactor concept is described. The development history is summarized, and all important areas of development are discussed. The discussion of the SGR program is broken into three categories: (1) general research and development, dealing with reactor physics, fuels and materials, components, etc., (2) experimental reactors, operating or in some phase of design or construction, and (3) power demonstration reactors, operating or in a design or construction phase. (W.D.M.)

22616 TID-8519

Atomic Energy Commission, Washington, D. C.

CIVILIAN POWER REACTOR PROGRAM. PART IV. PLANS FOR DEVELOPMENT AS OF FEBRUARY 1960. 1960. 24p. GPO.

In developing the program plans presented, primary attention was given to the technological development required to achieve economically competitive nuclear power. The program objectives are given in brief and the specific reactor program is discussed in some detail. The nuclear technology program is summarized. (W.D.M.)

22617 TID-8526

Gibbs and Hill., Inc., New York and Internuclear Co., Inc., Clayton, Mo.

SMALL SIZE PRESSURIZED WATER REACTOR CONCEPTUAL DESIGN. Apr. 11, 1960. 100p. Contract AT(40-1)-2589. OTS.

Conceptual design criteria for a reactor plant with a fossil fuel fired superheater, a conventional generator plant, and auxiliary systems constituting a complete operating unit capable of producing a gross electrical power output of 22,000 kw is presented. The reactor is to be of the heterogeneous pressurized-water type employing rod-type fuel elements of uranium dioxide, clad with a suitable metal for fuel containment, and to prevent contamination of the coolant at fission products. The U is to be enriched to no more than 10% wt. U^{235}. The reactor is to be designed to produce energy continuously for a sufficiently long period of time to warrant its use as part of the steam generator system for a base load power plant. Primary system pressures in the range of 1600 to 2200 psia are contemplated. The reactor complex design will provide natural circulation of reactor coolant to protect the core against damage upon simultaneous loss of both reactor coolant pumps and consequent scram from rated power operation. The reactor will be placed inside a vapor-tight container designed to protect against any credible radioactive hazard. (auth)

22618 WAPD-PWR(RD-1)-596

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

PWR HAZARDS SUMMARY SUPPLEMENT. Oct. 1959. 13p. Contract AT-11-1-GEN-14. OTS.

The significant differences between the Shippingport PWR replacement seed (PWR Core 1 Seed 2) and the present seed (PWR Core 1 Seed 1) from reactor hazards considerations are presented. Hazards studies which have been made concerning PWR Core 1 Seed 2 are enumerated, and conclusions and bases of the calculations are presented. (W.D.M.)

22619 WCAP-1413

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

MULTI-REGION REACTOR LATTICE STUDIES OF FUEL CYCLE DEVELOPMENT PROGRAM FOR THE PERIOD JULY 1 TO DECEMBER 31, 1960. Ira H. Coen. Apr. 11, 1960. 47p. Contract AT(30-1)-2176. OTS.

Critical experiments at high water-to-metal ratios using 2.7% enriched UO_2 stainless steel clad fuel rods and the associated core components from the Yankee critical experiment were performed to obtain critical mass data in the range of moderating ratios close to the optimum. Experimental work for the loose-lattice experiments was completed. Calculations of the critical mass at moderating ratios close to the optimum were made. (See also WCAP-1414.) (C.J.G.)

22620 WCAP-3270

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

NUCLEAR AND THERMAL CALCULATIONS FOR WCAP-4 IN-PILE EXPERIMENT. A. Bourina, W. Eich, J. J. Lombardo. [1960?]. 41p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. OTS.

A description of the nuclear and thermal analysis involved in the design of the WCAP-4 in-pile test is presented. Calculations reveal that no burn-out conditions are expected at the operating fluxes. Calculations of central core temperature and heat output are included. Various hot spot factor calculations for both non-local and local boiling conditions are also given. (J.R.D.)

22621 JPRS-2845

THE OPTIMAL TEMPERATURE OF REGENERATIVE PREHEATING OF WATER AT NUCLEAR POWER PLANTS. D. D. Kalafati. Translated from Teploenergetika 7, No. 4, 74-81(1960). 22p. OTS.

The optimal temperature was investigated with respect to regenerative preheating of water, under variable conditions, at nuclear power stations, working with heterogeneous reactors. Formulas are derived for calculating the optimal temperature for regenerative preheating of water, under the assumed conditions, and for the type of heat transfer agent and reactor used. (auth)

22622

MODERN REACTOR DEVELOPMENT FOR POWER PLANTS. W. Kliefoth. Atomkernenergie 5, 287-99(1960) July-Aug. (In German)

A discussion-session held in Vienna, April 22 to 29, 1960, on modern power reactor development is summarized. The discussions covered boiling water reactors, sodium-graphite reactors, advanced gas-cooled reactors, organic-cooled and -moderated reactors, and pressurized water reactors. (T.R.H.)

22623

START-UP CONDITIONS IN A URANIUM–GRAPHITE POWER REACTOR PROVIDING SUPERHEATED STEAM. V. V. Dolgov, V. Ya. Kozlov, L. A. Kochetkov, O. A. Sudnitsyn, and G. N. Ushakov. Atomnaya Energ. 9, 10-15 (1960) July. (In Russian)

Start-up conditions for a nuclear power plant with a uranium–graphite reactor which provides superheated steam directly in the reactor were investigated using the steam–water circuit of the First Atomic Power Plant. The circuit and various methods of start-up are described, and the advantages and shortcomings of various start-up methods are discussed. The feasibility of a start-up without an outside steam source is indicated. (tr-auth)

22624

REACTIVITY BALANCE IN A GRAPHITE–GAS TYPE POWER REACTOR. Baldassare Zaffiro (Società Italiana Meridionale Energia Atomica, Rome). Ing. nucleare 3, 81-9(1960) Mar.-Apr. (In Italian)

Only the sudden, step-like type of load changes are discussed, as these are responsible for the greatest alterations in reactivity. Reactivity variations resulting from load fluctuations are known to be due to three chief factors: fuel temperature, moderator temperature, and xenon concentration. These three factors, however, do not act simultaneously. As a matter of fact, while fuel exerts a nearly immediate, stabilizing effect (negative temperature factor), the moderator is featured by a time constant of several minutes, with a positive temperature factor under stabilized fuel conditions. Finally, xenon concentration will vary according to a certain pattern, reaching its peak after a few hours' time and slowly decreasing thereafter. The power control system (control bars) shall of course be so designed as to provide enough reactivity to overcome the transient stage the reactor is going through. The calculations developed were conveniently epitomized in a number of diagrams illustrating the respective behaviors of two reactors, one with and one without graphite sleeves, associated with a sudden, 100 to 70% load drop. An interesting remark is that the adoption of graphite sleeves, which is notoriously meant to avoid an excessive accumulation of Wigner's energy, makes the problem of controlling a reactor considerably more intricate, and calls for a special control-bar system to provide greater reactivity during the transient stage. (auth)

22625

SOME PROBLEMS OF DEVELOPMENT OF NUCLEAR POWER STATIONS WITH REACTORS USING WATER, WATER–VAPOR MIXTURE OR SUPER-HEATED STEAM AS HEAT REMOVAL MEDIUM. T. Ch. Margulova (Moscow Inst. of Power Engineering). Jaderná energie 6, 222-7(1960). (In Czech.)

Diagrams of some of the common types of nuclear power plants are given, and possibilities of their further development are discussed. The possibility of substituting cheaper construction materials in places where stainless steel is now used is also considered. (D.E.B.)

22626

SNAP UNITS WELL ALONG IN DEVELOPMENT. William Beller. Missiles and Rockets 7, 39–43(1960) Aug. 22.

SNAP 2, 8, and 10 are nuclear power units developed for use by NASA and the Air Force. The SNAP 2 system was designed to generate 3 kw, SNAP 8 30 kw, and SNAP 10 300 watts for an unshielded system weight of 355 lbs. The three systems will use similar reactors, employ the same materials, and be operated in the 1200 to 1400°F temperature range. The potential uses of these units and descriptions of each are presented. (M.C.G.)

22627

FUEL CYCLES. R. Rometsch (Eurochemic, Mol, Belg.). Neue Tech. 2, No. 6-7, 7-10(1960) June-July. (In German)

On the basis of the definition of "fuel cycles," the relative importance of the fuel cost in the production of nuclear energy is explained. The main fuel cycles are described, and it is pointed out that at the present time only cycles based on natural or slightly enriched uranium are of practical significance for nuclear power plants. Finally, the working program of Eurochemic in Belgium is discussed, which is shown to aim at the completion of our scanty knowledge on nuclear fuel cycles. (auth)

22628

PRICING BRED REACTOR FUEL. Milton C. Edlund (Babcock and Wilcox Co., Lynchburg, Va.). Nucleonics 18, No. 8, 64-5; 110(1960) Aug.

A computation was made to determine whether the buy-back prices set by the AEC for U^{233} and Pu are realistic. It is stated that a reasonable pricing system is to assign a value to the bred fuel that makes the energy cost of the equilibrium fuel just equal to the energy cost of the initial fuel cycle, before recycling starts. Starting with this definition, it is shown that, relative to the current prices for U^{235}, U^{233} is worth \$18 to \$20/g and Pu \$6 to \$8/g. These figures include a 0.5 mil/kwh penalty for the extra expense of fabricating recycle elements. This difference of a factor of three in the suggested prices for Pu and U^{233} has two sources: (1) in a thermal reactor U^{233} produces more fission neutrons per capture than does Pu; and (2) the uranium replaced by U^{233} in the Th–U^{233} is fully enriched and hence more expensive than the slightly enriched uranium with which Pu competes in the Pu–U^{238} cycle. (B.O.G.)

22629

IMPROVEMENTS IN NUCLEAR REACTORS. Anthony James Taylor (to Babcock & Wilcox Ltd.). British Patent 837,785. June 15, 1960.

A graphite-moderated, gas-cooled reactor design is given for operation under tilting or inverting movements such as may be encountered on ships. Core restraint is provided by lateral supports between the core body and the pressure vessel in the form of sectionalized walls surrounding the core. The walls are held together by links which compensate for differential thermal expansion and contraction of the core, keeping it continually supported without stress or gap development. Tubular members provide additional support. (D.L.C.)

22630

IMPROVEMENTS IN OR RELATING TO POWER PLANT. Anthony James Taylor (to Babcock & Wilcox Ltd.). British Patent 837,786. June 15, 1960.

A device was invented for preventing the escape of fluid from the closed circuit of a maritime graphite-moderated, gas-cooled reactor in the event of ship collision or some other accident, and for the maintenance of reactor cooling after such an accident. The device consists of a pressure-responsive envelope surrounding the circuit. When a rupture occurs in the circuit, the envelope is also ruptured, activating valves on the reactor ducts, and the circuit is broken. (D.L.C.)

22631

IMPROVEMENTS IN OR RELATING TO THERMAL POWER PLANTS. (to Escher Wyss Aktiengesellschaft). British Patent 841,920. July 20, 1960.

The design of a thermal power plant is presented. The plant includes a nuclear reactor and a means for transferring heat generated in the reactor to the working medium of a heat engine or to intermediate heat-carrying medium which gives up heat to the working medium in a heat exchanger. (W.L.H.)

22632

NUCLEAR ENERGY TURBINE. (to Esso Research and Engineering Co.). British Patent 841,972. July 20, 1960.

A process is presented for converting nuclear energy to mechanical energy which then can be converted to electrical energy. The process consists of compressing gas containing fissionable materials in a sub-critical condition to a critical degree. The fissionable gas is passed through a reaction zone which contains sufficient moderator to achieve a nuclear reaction in the gaseous medium. The enthalpy of the gaseous medium is increased and the gas is expanded through a turbine engine zone to reduce the enthalpy. The gaseous medium is then cooled and recycled. (W.L.H.)

22633
NUCLEAR REACTOR FOR THE PRODUCTION OF INDUSTRIAL ENERGY. (to Siemens-Schuckertwerke Aktiengesellschaft). French Patent 1,186,326. Feb. 23, 1959.

A liquid-cooled and -moderated power reactor is divided into two pressure zones. The higher pressure zone consists of a number of fuel-containing tubes connected on one side with an inlet header and on the other side by means of nozzles with the surrounding lower pressure zone. The latter zone is filled to a constant level with liquid, acting as moderator and reflector. This liquid is pumped to the inlet header, heated in the tubes, and returned through the nozzles to the lower pressure zone, expansion and formation of vapor thereby taking place. After utilization of the vapor the condensate is returned to the lower pressure zone. The passage width of the nozzles can be adjusted according to the neutron flux partition.

22634
METHOD OF FLUID TREATMENT AND APPLICATION TO A NUCLEAR POWER PLANT. (to Sulzer Frères, Soc. Anon.). French Patent 1,192,034. Apr. 13, 1959.

A water purification method for a pressurized water reactor power plant is given in which a fraction of the circulating coolant is isolated in a sluice chamber, depressurized, purified at the low pressure, again isolated in the sluice chamber, and finally returned to the high-pressure circuit. A flow scheme comprising two sluice chambers linked in parallel is given.

22635
METHOD FOR ELECTRICAL ENERGY PRODUCTION FROM NUCLEAR REACTIONS. (to L. & C. Steinmüller GmbH). French Patent 1,192,687. Apr. 20, 1959.

The heat generated in a nuclear fission or fusion reactor is used for thermally dissociating a circulating agent, e.g., steam or CO_2. This process may be catalytically accelerated. The dissociation products are separated from the agent and from each other (e.g., by selective diffusion), cooled, and led into a series of chemical reaction cells for the generation of an electromotive force. The recombined dissociation products are returned to the reactor. A bypass purification circuit is provided in order to maintain the desired purity of the agent and the dissociation products.

22636
METHOD FOR THE OPERATION OF GAS-COOLED GRAPHITE-MODERATED HIGH TEMPERATURE REACTORS. (to Brown, Boveri & Cie and Aktiengesellschaft für Unternehmungen der Eisen- und Stahlindustrie). German Patent DAS 1 058 164. May 27, 1959. Kerntechnik 2, 262(1960) July-Aug. (In German)

A nuclear reactor is described in which the coolant gas, a neon–helium mixture in naturally occurring mass ratio, is brought directly into contact with fuel elements of uranium carbide or a mixture of fuel elements and moderator. The coolant gas is fed to the closed circuit of a heat exchanger or gas turbine for heat transfer. The coolant gas diffusing through the walls of the primary circuit during the operation of the reactor is collected in a degassing device and reintroduced into the primary circuit.

Research Reactors

22637 CEA-1395
France. Commissariat à l'Énergie Atomique. Centre d'Etudes Nucleaires, Saclay.
L'UTILISATION DES ZONES D'IRRADIATION SITUEES DANS LE RESEAU D'ELEMENTS COMBUSTIBLES DES PILES DE RECHERCHE. (The Use of Irradiation Zones in the Fuel Element Lattice of Research Reactors). P. Delattre and J. P. Genthon. 1960. 25p.

The advantages and disadvantages of the various types of canal which may be found in the fuel element lattice of research piles are discussed. Some examples relative to the piles EL2 and EL3 are discussed in detail. From the conclusions drawn in the last part, several norms are extracted which make it possible to define the conditions the various canals must fulfill in order that they can be used to the best possible advantage for each type of irradiation. (auth)

22638 IDO-16170
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
COMPUTATION OF MATERIALS TESTING REACTOR CORE BURN-UP FOR ACCOUNTABILITY RECORDS. F. P. Vance and F. H. Tingey. June 1, 1954. 9p. Contract AT(10-1)-205. OTS.

Supersedes IDO-16021.

An equation for the computation of fuel burnup in the Materials Testing Reactor core is derived. This expression relates total loss (W) of U^{235} by both the (n,f) and (n,γ) reaction to fission energy (E), relative cross section ($\sigma c/\sigma f$), and total energy dissipated to cooling water during the period concerned (P) as reflected by the process flow rate (Q) and the temperature differential through the reactor tank (Δt), i.e., $W = (1.18)(F/L) \pm 5\%$ where $F/L = (1.07)(P) \pm 5\%$. The reported and assumed errors associated with each of the measurements were combined statistically and indicated that the calculated W has a limit of uncertainty of approximately 5 per cent for the usual level of reactor operation. It was indicated that the limits of uncertainty to be associated with the cumulative total of several charges is the linear sum of the uncertainties associated with each of the charges because of the consistent error reflected in each calculation by the common assumed value for the fission energy and the common calibration curve for Q. (auth)

22639 IDO-16666
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
PROPOSAL FOR AN ADVANCED ENGINEERING TEST REACTOR–ETR II. D. R. deBoisblanc, et al. Mar. 17, 1960. 223p. Contract AT(10-1)-205. OTS.

The results of a study are presented which was directed at providing additional experimental loop irradiation space for the AEC-DRD testing program. It was a premise that the experiments allocated to this reactor were those that could not be accommodated in the MTR, ETR, or in existing commercial test reactors. To accomplish the design objectives called for, a reactor producing perturbed neutron fluxes exceeding 10^{15} thermal neutrons per square centimeter per second and 1.5×10^{15} epithermal neutrons per square centimeter per second. To accommodate the experimental samples, the reactor fuel core is four feet long in the direction of experimental loops. The vertical arrangement of reactor and experiments permits the use of straight and vertical loops penetrating the top cap of the reactor vessel. The design offers a high degree of accessibility of the exterior portions of the experiments and offers very convenient handling and discharge of experiments. Since the loops are to be integrated into the reactor design and the in-pile portions installed before reactor startup, it is felt that many of the problems encountered in MTR and ETR experience will cease to exist. Installation of the loops prior to startup will have an added advantage in that the flux variations experienced in experiments in ETR every time a new loop is installed will be absent. ETR II (formerly called ETR IV) has a core configuration

which provides essentially nine flux-trap regions in a geometry which is almost optimum for cylindrical experiments. The geometry is similar to that of a four-leaf clover with one flux trap in each leaf, one at the intersection of the leaves, and one between each pair of leaves. The nominal power level is 250 Mw. The study was carried out in enough detail to permit the establishment of the design parameters and to develop the power requirement which, conservatively rated, will definitely reach the flux specifications. A critical mockup of an arrangement similar to ETR II was loaded into the Engineering Test Reactor Critical Facility. A two-dimensional calculation of this actual test provided a confirmation of validity of the computer techniques in predicting the behavior of this reactor. (auth)

22640 NP-8884

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

VTOROI GOD EKSPLUATA, TSII REAKTORA VVR-S v POL'SHE. (Second Year Experience in Operating WWR-S Reactor in Poland). E. Aleksandrovich. 1960. 48p.

A short review is given of experiences during two years of WWR-S reactor operation. Various experiments made on the reactor are described. Some remarks on the possibilities of adapting the reactor to experiments in the field of radiation chemistry are quoted. The results of the following most important measurements are given: change of built-in reactivity during operation, burn-up analysis of cooling water in the primary circuit, the radiolysis of cooling water, temperature distribution and heat removal measurements in the thermal column, and possibilities of increasing reactor power. Advances in radiation protection, control, and safety instrumentation are given. Some experiences in radioisotope production are described. (auth)

22641

THE ABSOLUTE MEASUREMENT OF THERMAL NEUTRON FLUX. N. Mateescu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 11, 83-96 (1960). (In Rumanian)

The thermal neutron flux in one of the horizontal experimental channels of the VVSR reactor was measured, gold being used as an activator. In order to minimize the error of the measurements, the activity produced by the epithermal neutrons, in the energy range from thermal neutrons up to the cut-off cadmium energy, was discarded. The correction factor due to weakening of the epicadmium neutron flux was also derived for the cadmium-covered gold foil. Owing to the β-γ coincidence scanning method used for the measurement of the induced β activity, the total error was reduced to about 10%. (auth)

22642

ACTIVITIES OF THE CEN AT GRENOBLE WITH RESPECT TO THE MELUSINE REACTOR. Claude Meunier (Commissariat á l'Energie Atomique, Grenoble, France) Inds. atomiques 4, No. 5-6, 74-82(1960). (In French)

After a short survey of the history of the Melusine Reactor from the first construction, the reactor experiments performed from March 1959 to March 1960 are reviewed. The various laboratories partaking in the experimentation are described. The importance of the health safety group is emphasized. Indications of the experiments planned for the rest of the year are given. Improvements on the irradiation facilities are discussed. (tr-auth)

22643

ESTIMATION ON THE ACTUAL TENDENCIES OF HIGH FLUX REACTORS. Réginald Lamarche (Société de Bruxelles pour la Finance et l'Industrie). Inds. atomiques 4, No. 5-6, 83-96(1960). (In French)

The role of high-flux reactors both in the domain of chemistry and physics and in reactor technology is examined. Among the high-flux reactors, those operating with light water are discussed in particular. Some problems posed by the construction of these reactors are then described with a consideration of their experimental space. The organization and safety considerations during construction are discussed. In-pile loops in high-flux reactors are then considered. In conclusion, some problems of dosimetry are reviewed. (tr-auth)

22644

IMPROVEMENTS IN NUCLEAR REACTORS. (to General Electric Co.). British Patent 838,528. June 22, 1960.

The design of a reactor to provide a readily accessible high neutron flux region is presented. The reactor consists of a core assembly, a neutron permeable pressure enclosure surrounding the core assembly, and a neutron reflector placed outside the pressure enclosure to provide a readily accessible high neutron flux region outside the pressure enclosure. (W.L.H.)

22645

ELECTRONUCLEAR REACTOR. E. O. Lawrence, E. M. McMillan, and L. W. Alvarez (to U. S. Atomic Energy Commission). U. S. Patent 2,933,442. Apr. 19, 1960.

An electronuclear reactor is described in which a very high-energy particle accelerator is employed with appropriate target structure to produce an artificially produced material in commercial quantities by nuclear transformations. The principal novelty resides in the combination of an accelerator with a target for converting the accelerator beam to copious quantities of low-energy neutrons for absorption in a lattice of fertile material and moderator. The fertile material of the lattice is converted by neutron absorption reactions to an artificially produced material, e.g., plutonium, where depleted uranium is utilized as the fertile material.

WASTE DISPOSAL AND PROCESSING

22646 ANL-6151

Argonne National Lab., Ill.

CHEMICAL DECONTAMINATION OF THE ANL-2 HIGH-PRESSURE WATER LOOP. C. C. Crothers. July 1960. 12p. Contract W-31-109-eng-38. OTS.

The chemical decontamination of the ANL-2 High-pressure Water Loop at the MTR is described. A mixture of sodium hydroxide and potassium permanganate was first applied to oxidize partially and loosen the magnetite corrosion film on the loop surfaces. Next, the system was treated with a solution of Versenol 120 to remove and suspend the loosened oxide film. The third chemical treatment was a mixture of sulfamic acid, HEDTA, hydrazine, and Rodine 80. After the first two chemical treatments a brown residue remained, which was presumed to be manganese dioxide. The third solution completely removed all traces of residue from the first two treatments. After a delay of one MTR fuel cycle (three weeks) due to mechanical difficulties, the loop was operated for approximately 300 hours at 420°F and 380 psig with excess hydrogen to passivate the loop surfaces. Approximately 70% of the corrosion film was removed from the loop surfaces as a result of the chemical decontamination. (auth)

22647 GAT-P-20

Goodyear Atomic Corp., Portsmouth, Ohio.

RAIN WATER LEACHING OF BURIED CONTAMINATED ALUMINA. W. S. Fleshman. July 28, 1960. 11p. Contract AT(33-2)-1. OTS.

Laboratory experiments were conducted to determine the leaching effect of rainwater on buried alumina containing uranium. It was found that treating acid-leached alumina with caustic soda before burial neutralized the acid and converts the uranium into an insoluble diuranate which is absorbed by the alumina. Very little uranium is rain leached from the alumina after such procedure. (J.R.D.)

22648 HW-62048

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

AN IN-WELL PERMEABILITY TESTING PACKER. J. R. Raymond. Sept. 29, 1959. 8p. Contract AT(45-1)-1350. OTS.

The design and evaluation of an in-well permeability testing packer are described. The work was an effort to develop a method of measuring relative permeability of formations in the Hanford area. The method does not appear feasible for routine use in the Hanford wells; however, wells which are drilled, cased, and subsequently perforated using the shaped charge method may provide acceptable test sites. (J.R.D.)

22649 HW-63949

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

FIXATION OF RADIOACTIVE RESIDUES; RESEARCH AND DEVELOPMENT ACTIVITIES QUARTERLY PROGRESS REPORT FOR OCTOBER–DECEMBER 1959. D. W. Pearce, ed. Jan. 15, 1960. 20p. Contract AT(45-1)-1350. OTS.

Waste calcination studies were made in a fluid bed reactor using an aluminum nitrate feed. Studies were initiated in the fluid bed calciner, and 18 short runs were completed using simulated ICPP waste as feed solution. The nominal operating conditions during most runs are reported. A total of eight laboratory-scale batch calcination studies of simulated Purex-type wastes were made. Equipment was completed for heat transfer studies in batch-calcined materials. In radiant-heat spray calcination, equipment modifications were made because of corrosion of sintered stainless steel filters from the use of simulated high-sulfate Purex waste, a new filter section was build to employ ceramic filters. Nonradioactive ruthenium and cesium were added to a feed simulating Purex 1 WW which was acid-killed with formaldehyde, concentrated by a factor of two, and neutralized. Samples of feed product powder, condensate, scrub solution, and an alkaline permanganate wash of off-gas lines were analyzed to determine the behavior of ruthenium and cesium in this feed in the spray calcination process. A study of radiation effects on materials of interest in waste fixation was initiated by a review of pertinent literature. (For preceding period see HW-63048.) (W.L.H.)

22650 IDO-14514

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

RADIOACTIVE WASTE DISPOSAL PROJECTS. IDAHO CHEMICAL PROCESSING PLANT TECHNICAL PROGRESS REPORT [FOR] JULY–SEPTEMBER 1959. C. M. Slansky and F. M. Warzel—J. I. Stevens, ed. July 8, 1960. 22p. Contract AT(10-1)-205. OTS.

The progress of extensive laboratory and pilot plant investigations on the fluidized bed process for the conversion of radioactive liquid wastes to solids is reported. These studies are directed toward obtaining information on the dynamics of fluidized bed operation, the removal of volatile fission products and solids particles from gases, the development of equipment and operating techniques, and the various long term disposal aspects of all radioactive wastes. Laboratory studies on the removal of volatile ruthenium from a simulated calciner off-gas showed the removal efficiency of silica gel to decrease with successive wetting and drying cycles. Electrostatic precipitators were found to have a higher removal efficiency for solid particles (alumina) when a wetted wall rather than a dry wall type was used. Tests to determine the distribution of ruthenium in a pilot plant calciner were performed. Pilot plant data on particle growth in a fluidized bed were compared with theoretical equations. Operating experience with a NaK heat transfer system, and with liquid flow controllers is reported. The results of a series of qualitative tests to determine the likelihood of an explosive reaction should NaK leak into a fluidized bed calciner indicated that such a reaction is unlikely. A NaK leak that occurred at a welded junction was attributed to thermal overstressing of the metal and not due to corrosion. Calcium fluoride-impregnated Teflon was found to be a superior gasketing material, both chemically and mechanically, to pure Teflon. A literature survey on the chemistry of zirconium in a calcination process suggested the possibility of calcination in contact with silica and a laboratory unit is being installed to study the process. The hydraulics of a pulsed plate solids-liquid contactor and its associated equipment were determined. A preliminary investigation was started of the possibility of using metallizing techniques to surface coat solid particles and thereby reduce the leaching of fission products when contacted with ground water. Construction of a demonstrational fluidized bed calciner was approximately half completed; however, the national steel strike has slowed the construction schedule and the completion date cannot be estimated until the strike is settled. Process and equipment reviews of the facility and the results of thermal conductivity measurements on Idaho sands are reported. (auth)

22651

CONSIDERATIONS ON THE DISPOSAL OF RADIOACTIVE WASTES. W. F. Vinck (Institut Technique Supérieur de l'Etat pour les Industries Nucléaires, [Brussels]). Ind. chem. belge 25, 657-67(1960) June. (In French)

The disposal of radioactive wastes is examined with a discussion of the origin of wastes and a prediction on the quantities from each source. Safety and economic considerations in this field are then reviewed. Methods studied and utilized for liquid and solid wastes are discussed. Gaseous wastes are considered separately. Final disposal in the sea and underground is described, with a tabulation of techniques developed since the Geneva Conference in 1958. (J.S.R.)

22652

International Atomic Energy Agency, Vienna.

DISPOSAL OF RADIOACTIVE WASTES. VOL. 1. CONFERENCE PROCEEDINGS, MONACO, 16-21 NOVEMBER 1959. 607p. 1960. $6.00. International Publications, Inc., N. Y.

The proceedings of the Scientific Conference on the Disposal of Radioactive Wastes are presented. A total of 283 scientists, representing 31 countries and 11 international organizations, attended the conference. 31 papers are included; separate abstracts have been prepared for 28. Abstracts of 3 papers previously appeared in NSA.

Nine papers are presented in both the original language and in English translation. (B.O.G.)

22653

MANAGEMENT OF WASTE FROM THE USE OF RADIOISOTOPES. Lester R. Rogers (U. S. Atomic Energy Commission, Washington, D. C.). p.51-62 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Examinations were made of the origin and nature of radioactive waste generated in the use of radioisotopes in industry, medicine, agriculture, and research; the relationship between types, quantities, and uses of radioisotopes; and disposal of the radioactive waste generated in their use. The methods used for the disposal of such waste under the licensing controls of the USAEC were discussed. These methods include: 1. The controlled discharge of low concentrations of effluents into streams and into the atmosphere; 2. Controlled release of small quantities of soluble or readily dispersible waste products into sanitary sewage systems; 3. Burial, under controlled conditions, of small quantities of waste in the soil; 4. Return to AEC installations of radioactive waste for storage or land burial; 5. Treatment by incineration; and 6. Disposal of packaged waste at sea. Reviews are given of the criteria and regulatory requirements applicable to each method of disposal to accomplish the objective of preventing the waste from entering the food chain of man in hazardous quantities, or of adversely affecting the use of the environment by man. Limitations on the types, quantities, and methods of disposal are discussed for which private concerns can be licensed due to long-term responsibility for maintenance of burial grounds or storage facilities. (auth)

22654

ORIGIN, NATURE, DISPOSAL AND CONTROL OF RADIOACTIVE WASTES ARISING FROM THE USE OF RADIOISOTOPES. A. W. Kenny (Ministry of Housing and Local Government, [Eng.]). p.63-72 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

A description is given of different types of radioactive wastes arising from industrial, medical, and scientific uses of radioisotopes. An outline is given of methods used for waste disposal, depending on the content of radioactivity. (auth)

22655

PROBLEMS TO BE EXPECTED IN DISPOSING OF FISSION PRODUCTS FROM A POSSIBLE NUCLEAR POWER PROGRAMME. G. K. Dickson (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). p.73-88 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

A typical British nuclear power program covering the next few decades is examined. The types of reactor to be erected and the types of fuel to be initially used in them are well appreciated but the conclusions will necessarily become less certain with the passage of time. The chemical processes which must be applied to irradiated fuels will depend on the type of fuel, its burn-up etc., and so will change during the period under review. Consideration is given to the quantities of fission products and heavy isotopes which may be produced, the forms in which they may leave the chemical processing streams and the methods available for handling them safely, either by storage or by disposal. (auth)

22656

FORECASTING THE QUANTITY AND ACTIVITY OF FISSION PRODUCTS IN FRANCE IN FUTURE YEARS IN THE LIGHT OF ATOMIC ENERGY DEVELOPMENT. J. Guirlet and J. M. Lavie (Commissariat à l'Énergie Atomique, Saclay, France). p.89-105 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In French and English)

With the aid of Wigner and Way's formula it is possible to predict theoretically the activity of the complex mixture of fission products originating in a reactor. The study of prospective nuclear power production in France is considered to 1975. It is assumed that the uranium stays in the reactor for periods of three and six months. It is possible to determine the activity of a given fission product and to calculate its decay time. The substance selected was strontium for an activation period of three months. Each group of curves shows total activity at any moment and the activity of particular fission products over a given period. (auth)

22657

DISPOSAL OF WASTE INTO THE ATMOSPHERE. H. F. Schulte (Los Alamos Scientific Lab., N. Mex.). p.111-24 of "Disposal of Radioactive Wastes. Vol 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The atmosphere can be compared to the hydrosphere and the lithosphere as a recipient of wastes, but the presence of airborne wastes is of more immediate concern to human life. There are two very distinct problems presented by atmospheric pollution; (1) that in the immediate vicinity of a plant and (2) the world-wide problem from long-term, widespread air pollution. Short-range problems have existed for many years as a result of non-radioactive wastes such as coal-smoke, sulphur dioxide, and hydrogen fluoride. In recent years this problem has received intense scientific study. Meteorological conditions play an important role in the problem. In some cases emission rates were controlled in keeping with meteorological predictions. The basic solution is still that of reducing emission rates to the lowest possible values. (auth)

22658

ON THE WASTE DISPOSAL POTENTIALITY OF THE ATMOSPHERE. S. H. Small and P. B. Storebø (Norwegian Defence Research Establishment, [Oslo]). p.125-35 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The whole scale of atmospheric mixing, transport, and removal processes is reviewed. Certain measurements indicate replacement of stratospheric air within about two years, making high-altitude disposal of radioactive waste materials even less attractive than earlier assumed. Deposition of radioactive materials is to some extent systematically non-uniform, and permissible levels of atmospheric radioactivity should be based upon the probable hazards in the most exposed regions, e.g. regions of considerable orographic precipitation. In connection with the measurement of atmospheric radioactivity, it is pointed out that sampling techniques should cover the probable effects of gradual changes in particle sizes, and removal of particles by settling, impingement, and absorption on vegetation and buildings. Meteorological problems in connection with radiation monitoring and warning systems are

discussed in relation to reactor operations. Technical details of relatively simple warning systems are given. (auth)

22659

ECONOMIC ASPECTS OF AIR AND GAS CLEANING FOR NUCLEAR ENERGY PROCESSES. Leslie Silverman (Harvard School of Public Health, Boston). p.137-79 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The basic requirements for control of gaseous and particulate effluents are given as applied to problems of feed material production, isotope separation, fuel element fabrication, fuel recovery, and reactor operation. There are instances where non-radioactive nuclear materials with toxic or nuisance effluents such as from beryllium and zirconium production are of concern and these too must be controlled at reasonable costs. The factors involved in capital and operating costs of gas cleaning equipment and the types of applications in the United States are described. Gaseous effluent problems were attacked and controlled by several types of device but their performance was measured on a comparable basis. It is thus possible to judge operating characteristics on an economic basis as related to power consumption, adsorbent costs, space charges, corrosion problems, and other operational factors. The USAEC through its contract with the Harvard University Air Cleaning Laboratory initiated an evaluation program with cooperation from the various facilities and contractors to the Commission. In this study the basic factors necessary to obtain quantitative cost delineation and evaluation are outlined and some preliminary findings are presented. A review of other economic studies made in the United States on particular process or facility applications is presented. (auth)

22660

TEMPERATURE DISTRIBUTION IN RADIOACTIVE SOLID WASTES. PART I. BETA-ACTIVE SOLIDS. D. A. Kotewale and A. K. Ganguly (Atomic Energy Establishment, Trombay, India). p.213-24 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Calculations are made for temperature distribution over time in a radioactive sphere and in a finite radioactive cylinder buried in a medium having the same thermal properties. Formulae are given for such calculations. Numerical results on temperature build-up are presented graphically for the cases where the activity is due to beta-emitters such as P^{32}, Sr^{89}, Cs^{135}, and $Sr^{90} + (Y^{90})$. General graphs for calculation of temperature build-up for any long-lived beta-emitter at certain points of interest in a sphere and in a cylinder of particular dimensions and diffusivity are presented. (auth)

22661

PROCESSING AND PRETREATMENT OF SOLID RADIOACTIVE WASTE. P. Cerré (Commissariat à l'Énergie Atomique, Saclay, France). p.225-34 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In French and English)

As solid radioactive waste varies in form, dimensions and volume, the Atomic Energy Commission first of all reduces the volume by breaking up and compressing the waste. Since the temporary storage of such waste is always attended by the risk of contamination, an efficient packing system was devised and adopted. This consists of embedding the waste in the heart of a specially-designed block of concrete possessing the following characteristics: great strength, maximum insolubility, resistance to corrosion, maximum imperviousness, and protection against radiation. It is thus quite safe to store these blocks with a view to final dumping. (auth)

22662

A SOLUTION FOR THE STORAGE OF RADIOACTIVE SLUDGE IN THE GROUND AT MARCOULE. P. Cohen and C. Gailledreau (Commissariat à l'Énergie Atomique, Saclay, France). p.235-61 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In French and English)

A discussion is given of the treatment of radioactive sludge from the effluents of the Marcoule plant. The sludge is stored in drums, and the hazard created by seepage through the soil with the gradual deterioration of the drums was investigated. This economic solution may be applicable in certain cases. (auth)

22663

STORAGE AND DISPOSAL OF SOLID RADIOACTIVE WASTE. J. Pomarola (Commissariat à l'Énergie Atomique, Saclay, France). p.263-82 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In French and English)

Solutions for the problem of final disposal of solid radioactive waste are considered. It is first essential to organize a proper system of temporary storage. In order to organize final storage, it is necessary to fix, according to the activity and form of the waste, the site and the modes of transport to be used within and outside the nuclear center. The choice of solutions follows from the foregoing essentials. Final storage on the ground, in the sub-soil, and in the sea is considered. Economic considerations are an important factor in determining the choice of solution. (auth)

22664

HANDLING AND TRANSPORT PROBLEMS. J. Pomarola and J. Savouyaud (Commissariat à l'Énergie Atomique, Saclay, France). p.283-94 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In French and English)

The handling and transport of radioactive waste involves the risk of irradiation and contamination. It is necessary to draw up special regulations governing the removal and transport of waste within the centers or from one center to another, and to entrust transport to a group in charge of specialized teams. The organization, equipment, and efficiency of such teams are considered. Certain types of transport operation are particularly dangerous and require special transport units and fixed installations. This applies, in particular, to the disposal of highly radioactive liquids. A description is given of a composite transport unit, consisting of a towing vehicle, semi-trailer, and tank holding 500 l of liquid with an activity of up to 1,000 c/l. The drawing-off of the liquid waste, routing of the transport unit and precautions to be taken are discussed. (auth)

22665

DISPOSAL OF LOW-ACTIVITY LIQUID EFFLUENTS BY DILUTION. P. Bovard and C. Candillon (Commissariat à l'Énergie Atomique, Saclay, France). p.301-31 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, Interna-

tional Atomic Energy Agency, 1960. (In French and English)

From the results obtained in France by monitoring radioactivity in the neighborhood of nuclear plants, some conclusions may be drawn regarding the choice of disposal procedures. I. Results obtained: In 1957 a progressive study was started of the effect exerted by nuclear plants. In order to establish the proportion due to the nuclear centers, the study comprises determinations of the levels of natural radioactivity and artificial contamination. Examples related to reference areas are quoted. The greater part of artificial radioactivity is apparently due to radioactive fall-out. This is not surprising, considering the quantities of radioactive isotopes disposed of in France to date. Some laboratory tests were made. These helped to determine certain mechanisms, increased the knowledge of site pollution, and enabled the improvement of sampling methods. II. Laboratory tests: These were concerned with— 1. adsorption phenomena similar to those occurring in rivers and streams in the course of effluent dilution: fixation on finely-divided minerals, e.g. mica and quartz. Radioisotopes such as Sr^{90}, Cs^{137} and Y^{90} appear to behave very differently: under average disposal conditions Sr^{90} seems to be the least adsorbed; 2. soil and plant contamination, utilizing columns and cubes of soil in situ. It was found necessary to standardize the samples so as to facilitate further analysis and make the results comparable. III. Site selection and ways and means of disposal: From this group of still incomplete results and studies attempts are being made to educe certain principles to govern site selection. Once the site is chosen, the experience gained enables natural conditions to be considered. (auth)

22666

TREATMENT OF RADIOACTIVE EFFLUENTS AT THE SACLAY NUCLEAR RESEARCH CENTRE. G. Wormser (Commissariat à l'Énergie Atomique, Saclay, France). p.333-50 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In French and English)

Reported are four years' experience in operating the treatment plant for effluents from the Saclay Nuclear Research Center. Data relating to the origin, volume, and treatment of waste are included. (auth)

22667

THE DECONTAMINATION OF LOW-LEVEL RADIOACTIVE WASTE WATER AT RISÖ RESEARCH ESTABLISHMENT. Ib Larsen (Danish Atomic Energy Commission, Risö). p.351-9 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Because of the low rate of water renewal in the recipient, Roskilde Fiord, an efficient decontamination plant incorporating an evaporator was constructed at the Risö research establishment. It is intended that the activity of the fiord-water at a distance of ten meters from the discharge point shall be less than one-tenth of the drinking-water tolerance. This will correspond to ~1 millicurie per month contained in ~5000 m^3 of effluent. A description of the control and collection of laboratory effluents, of the decontamination plant and of the residue storage building is given. The results of current experiments dealing with the decontamination factor and the economic aspects of the problem are given. (auth)

22668

FACILITIES FOR WASTE MANAGEMENT AT CHALK RIVER, CANADA. C. A. Mawson and A. E. Russell (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.361-71 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The waste disposal areas used by the Atomic Energy of Canada Limited are situated in a rock basin filled with glacial till and sand, draining into the Ottawa River. Low-activity liquid effluent is run into pits in the sand, which are filled with small rocks to prevent contact of liquid with the air. Medium-level liquid is mixed with cement in drums which are stacked and totally enclosed in concrete trenches; medium-level solids are buried in concrete-lined trenches; high-level solids are placed in holes lined with steel or concrete piping. Special facilities are provided for organic liquids and bottled wastes. Details are given of the structural work and procedures, with an outline of the results of environmental monitoring. (auth)

22669

THE PERMANENT DISPOSAL OF HIGHLY RADIOACTIVE WASTES BY INCORPORATION INTO GLASS. L. C. Watson, A. M. Aikin, and A. R. Bancroft (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.373-93 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Development of a process for the incorporation of the high-level wastes from chemical processing operations into glass for permanent disposal was continued at Chalk River. The process was demonstrated by making glass containing up to 50 curies of five- to six-year old mixed fission products per kg. The operation was batchwise, on a scale of four kg per batch. These operations showed that the fission products could be incorporated into glass safely and conveniently. Consideration of the many problems involved in the permanent storage or disposal of the highly radioactive glass resulted in the conclusion that it should be buried in the ground or stored in artificial vaults. In such conditions, the disposal may always be subjected to further control if required. If disposal is made directly to the ground, the principal method by which fission products can be released to the environment is by leaching from the glass into water. It is considered important to know the rate at which fission products will be dispersed by this mechanism. Considerable data on leaching by water were obtained in the laboratory. It was found that the rates of release depend on the composition of the glass. For all the compositions tested, measurements showed that the rate of leaching of fission products from the glass decreased with time. After several months in water the rate of release of several compositions was about 10^{-4} % per year from a two kg hemisphere of glass. The data obtained were used to estimate the release of fission products from glass containing the large quantities of fission products which will accumulate from operation of power reactors. (auth)

22670

THE PRACTICE OF WASTE DISPOSAL IN THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY. H. J. Dunster and L. F. U. Wix (United Kingdom Atomic Energy Authority, [Harwell, Berks, Eng.]). p.403-9 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The United Kingdom Atomic Energy Authority operates establishments in locations ranging from the South of England to the North coast of Scotland. The functions of

these establishments include the production and processing of nuclear fuels, the production of electricity and isotopes for commercial sale, the development of new types of reactors, and the conduct of research in all the associated fields. The Authority has a wide variety of wastes to deal with and they arise in a number of different places. The main high-activity wastes, both liquid and solid, are stored in special tanks and containers, while the low-activity large-volume liquid wastes are released in carefully controlled amounts to the sea or to rivers. Low- and medium-activity solid wastes are buried in selected areas where there will be no interference with water supplies, or sunk on to the sea bed. The methods in use are summarized and typical quantities of liquid and solid waste arising annually for disposal by the various methods are given. (auth)

22671

RADIOACTIVE WASTE CONTROL AT THE UNITED KINGDOM ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL. R. H. Burns (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.411-30 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Outlines are given of the present practices in the control and treatment of radioactive wastes at Harwell. The large-volume, low-level active liquid effluent is treated by phosphate coagulation methods and, eventually, discharged to the River Thames. The medium-level wastes are segregated and undergo a two-stage chemical treatment followed by passage through columns of Vermiculite. The latter process was found to be effective in removing radiocesium, which is not dealt with efficiently by the precipitation methods used. Liquid wastes with a high-activity content are stored and a new plant, incorporating chemical treatment, ion exchange, and evaporation, is being installed. The chemical sludges formed in the treatment processes are dumped at sea after de-watering by filtration. The contaminated solid waste is either stored or disposed of at sea. It is important to reduce the volume as much as possible and the methods employed include pressure baling, melting, and incineration of combustible matter. Small quantities of activity are discharged to the atmosphere through exhaust stacks. The cleaning of this discharge air is commonly achieved by the use of high-efficiency filters or liquid scrubbing systems. Regular stack monitoring is carried out and this is backed up by a comprehensive district sampling program. (auth)

22672

SOME QUESTIONS ON THE FIXATION OF RADIOISOTOPES IN CONNECTION WITH THE PROBLEM OF THEIR SAFE BURIAL. P. V. Zimakov and V. V. Kulichenko. p.431-47 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In Russian and English)

The results given are based on the fact that the best way of burying fission products is to incorporate them in vitrified fused blocks containing these fission products. The physico-chemical bases of the transformation of liquid waste into solid blocks are shown. The thermogram of this process is presented and the analysis of its characteristics given. The conditions of fusion of the vitrified mass, in particular those contributing to the fixation of radioactive aerosols, are shown. Some results of studies on the chemical state of radioactive fission products in the solid mass in connection with the leaching of their radioactivity are given. The results of calculations of the temperatures up to which the radioactive blocks may be heated according to their characteristics are presented. (auth)

22673

TREATMENT AND PROCESSING OF RADIOACTIVE WASTES. Walton A. Rodger (Argonne National Lab., Ill.). p.449-79 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Various methods considered for processing and treating radioactive wastes of both low and high level are discussed. Low-Level Wastes—Gases are diluted and discharged to the atmosphere through stacks or are filtered through highly retentive filters. Typical installations are described. Incineration of combustible wastes was examined and descriptions and operating data are given. Baling is often a useful adjunct to a solids collection system. A variety of processes for liquid wastes were studied. Typical systems are described and operating data given. High-Level Wastes—Gases are sometimes vented directly through stacks but more often some treatment is required. The treatment takes the form of chemical scrubbing, removal of iodine on silver reactors, rare-gas removal, and filtration. Highly contaminated solids may require decontamination in place before they can be removed. High-level liquid wastes represent the largest single waste-disposal problem facing the industry at the present time. This problem includes reduction in the volume of the waste originally produced by process changes or changing the process; concentration of the produced waste or reduction to solids by one of several methods including concentration, use of Portland cement, adsorption on clays or other natural materials, and calcination. The technical and economic problems associated with temporary storage are considered. It may become necessary to do waste processing at only a few carefully selected sites. Estimates are made of the amounts that might be involved in transport and of the equipment needed. The attendant hazards and costs are considered. (auth)

22674

RADIOACTIVE WASTE FACILITIES AT THE AUSTRALIAN ATOMIC ENERGY COMMISSION RESEARCH ESTABLISHMENT. C. L. W. Berglin, L. H. Keher, G. L. Miles, and A. R. W. Wilson (Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales, Australia). p.509-23 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

A description is given of facilities for the collection, treatment, and disposal of radioactive wastes at Lucas Heights in relation to the estimated arisings. Low-activity effluent is divided into three types: (a) Sewage; (b) Trades waste, arising from reactor cooling tower blow-down and engineering workshops and other inactive areas; and (c) Effluent arising from laboratories and other active areas. The effluent treatment plant for the latter type of effluent consists essentially of mixing and alkali dosing tanks, a sludge-blanket clarifier (using a calcium-iron-phosphate process), and holding tanks. Methods of concentrating the sludge and of secondary treatment are at present being investigated and are discussed. The discharge formula and the expected dilution obtained in the Woronora river are discussed, together with a dilution experiment carried out in the tidal waters. It is proposed to bury all low-activity solid waste after baling where appropriate and the choice and location of the disposal area are discussed. A facility

for the storage and disposal of highly active solid waste is discussed. It is proposed to evaporate and store the medium- and high-activity liquid waste. Details are given of the capital and operating costs of the Effluent Treatment Plant and other waste handling facilities. (auth)

22675

TREATMENT OF RADIOACTIVE WASTE AT JAPAN'S ATOMIC ENERGY RESEARCH INSTITUTE. Yutaka Yamamoto (Univ. of Tokyo and Japan Atomic Energy Research Inst., Tokyo), Masukuni F. Ito, Takehiko Ishihara, Nobuo Mitsuishi, and Sadahire Sakata. p.525-33 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

A description is given of the origin, nature, and treatment of the radioactive wastes. The very low-level liquid waste is diluted and released to the sea, while the low- and medium-level liquid waste is treated by flocculation, evaporation and ion-exchange methods. The solid waste is collected and the combustible waste incinerated. (auth)

22676

THE PUBLIC HEALTH PROBLEMS OF NUCLEAR WASTE DISPOSAL. H. J. Dunster (United Kingdom Atomic Energy Authority, [Harwell, Berks, Eng.]). p.543-9 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

The fundamental bases of the control of public health problems in connection with the disposal of radioactive wastes are the Recommendations of the International Commission on Radiological Protection. These Recommendations cannot be applied directly to the disposal of waste because the released radioactivity rarely reaches man in a direct manner. The setting of maximum permissible discharge rates involves a knowledge not only of man's utilization of his environment but of the diverse processes which govern the behavior of radioactive materials in that environment. As an example of the way in which the United Kingdom has dealt with these problems a discussion is given of the discharge of low-activity liquid wastes into the sea, and similar problems of assessing discharges into rivers and disposal into the ground or the deep sea. It is concluded that it is possible to demonstrate without difficulty the safety of most proposed waste-disposal operations but that meticulous investigation and control are necessary whenever substantial amounts of radioactivity are to be released to man's environment. (auth)

22677

TECHNICAL AND ADMINISTRATIVE CONSIDERATIONS IN THE MANAGEMENT OF RADIOACTIVE WASTES. Abel Wolman (Johns Hopkins Univ., Baltimore and Division of Reactor Development, AEC) and Joseph A. Lieberman. p.551-61 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

A discussion is given of the technical and administrative aspects of radioactive waste management in the light of present experience and knowledge and to relate that discussion to possible future requirements for the adequate engineering, legal, and administrative control of radioactive effluents from atomic energy operations. Initially, the various kinds of radioactive wastes are classified in a general way to emphasize that the many-faceted problem of waste management is not susceptible of a single, unique solution. The role of specific environments in waste management practices is briefly summarized and the basic approaches ("dilute and disperse" and "concentrate and contain") to waste control are defined. A distinction is made between basic radiation protection standards and the operating or performance criteria that must be established in connection with effluent control operations in order to assure that the basic standards are met. The development of standards and criteria and their application in the promulgation of health and safety regulations and legal and administrative procedures are discussed. In this connection, the utilization to the maximum practicable extent of existing laws and administrative procedures through existing authorities at various levels of government is suggested as being advantageous from the points of view of public relations and of administration. Although the total costs for treatment and disposal of radioactive wastes are substantial, the cost per unit of electrical energy produced is a rather small percentage of the total cost per unit of energy. Other economic factors related to handling and disposal of wastes are noted, including the relation of plant site to disposal location. Other considerations related to waste management, such as site selection and transport, are discussed. (auth)

22678

LEGAL AND ADMINISTRATIVE PROBLEMS OF CONTROLLING THE DISPOSAL OF NUCLEAR WASTES IN THE SEA. Lee M. Hydeman and William H. Berman (Univ. of Michigan Law School, [Ann Arbor]). p.563-71 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

A discussion is given of some approaches to multinational control of the sea disposal of nuclear wastes; considering both the type of international control which may be appropriate and the means for accomplishing such control. A brief description is given of the kind of control which appears to be necessary in protecting public health against the hazards of the disposal of wastes in the sea. Legal problems posed by nuclear wastes are analyzed. Emphasis is placed on the authority of coastal states to impose unilateral control on the disposal of wastes by other nations if such disposal might adversely affect their interest. Inquiries are made into the adequacy of legal remedies as well as the possible rule of law regarding the prevention of damage from waste disposal and the apportionment of liability in the event that such damage does occur. An analysis was made of how other problems of control were handled, both unilaterally and multilaterally. An inquiry was made into various means of internationally controlling the sea disposal of nuclear wastes. The role of existing international bodies in the maintenance of continuing administrative control at the international level is mentioned. (auth)

22679

THE HYDROGRAPHICAL FEATURES OF THE BALTIC SEA AND THE DISPOSAL OF RADIOACTIVE WASTES. Ilmo Hela (Inst. of Marine Research, Helsinki). p.573-87 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Pointed out are a few hydrographical features of the Baltic Sea, which make this sea, in reference to the disposal of radioactive wastes, different from any oceanic region. The seas can be divided, in reference to the practical problem of the disposal of radionuclides, into the following zones: (1) harbors, (2) fairways leading into harbors, (3) outer continental shelf, and (4) the open sea. There is no open sea, in the above sense, in the Baltic Sea. In addition, the validity of the rules recommended for the

above zones, must be carefully checked through further hydrographical studies, since: (1) the whole Baltic is, in a sense, an estuary, with a sill-depth of only 18 meters in the Danish Sounds, and (2) the mixing in the Baltic Sea is much more restricted than in the oceans, since the Baltic is rich in islands, brackish, heavily stratified, practically tideless, in winter partly covered with ice, and has a limited fetch of wind and only slowly moving permanent currents. Reference is made to all these factors which diminish the turbulent diffusion, both vertical and horizontal. For the evaluation of the advection and turbulent (eddy) diffusion, both in the upper water layers and at the bottom, synoptic observations of current velocity and salinity at a number of points in several regions of the Baltic Sea and under different weather conditions are needed. (auth)

22680

SOME INTERNATIONAL LEGAL ASPECTS OF THE ENCLOSED SEAS, ESPECIALLY THE BALTIC SEA, WITH REGARD TO THEIR PROTECTION AGAINST POLLUTIVE AGENTS. E. J. Manner (Advisory State Committee on Water Pollution, Helsinki). p.589-600 of "Disposal of Radioactive Wastes. Vol. 1. Conference Proceedings, Monaco, 16-21 November 1959." Vienna, International Atomic Energy Agency, 1960. (In English)

Enclosed or intra-continental seas should be distinguished from lakes, because the systems of the international law of the sea and international water-law differ from each other. The definitions of the enclosed sea used in the literature are not satisfactory; a new and more appropriate definition is proposed. The main sources of the international law of the sea are four Conventions adopted by the United Nations Conference on the Law of the Sea held at Geneva in 1958. Many of the problems concerning the Baltic are characteristic of other intra-continental seas. Reference is made to these problems and to the considerations that render the provisions of the Conventions on the Law of the Sea inadequate for the case of the enclosed seas. With regard to the prevention of pollution of the sea and the disposal of radioactive wastes, the rules of international law are still undeveloped. Mention is made of the aspects that should be considered when drawing up regulations and taking measures for the prevention of pollution, especially of the enclosed seas. (auth)

22681

METHOD FOR CLEANING RADIOACTIVELY CONTAMINATED OBJECTS. (to Bendix Aviation Corp.). French Patent 1,183,942. Feb. 2, 1959.

Contaminated objects are freed from adhering radioactive substances by ultrasonic cleaning. The objects are immersed in a cleaning liquid within a deformable container, consisting of metal foil or a synthetic resin and having a wall thickness of less than 1.6 mm; this container is placed in an ultrasonic cleaning apparatus. After cleaning and removal of the object, the container is provided with a substance having absorbent properties for the suspended radioactive particles, and then is sealed and disposed of.

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